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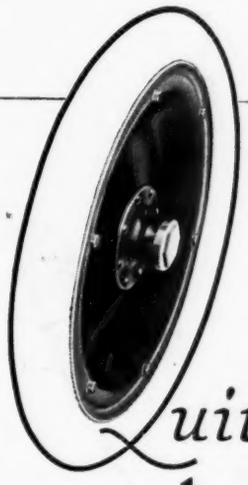

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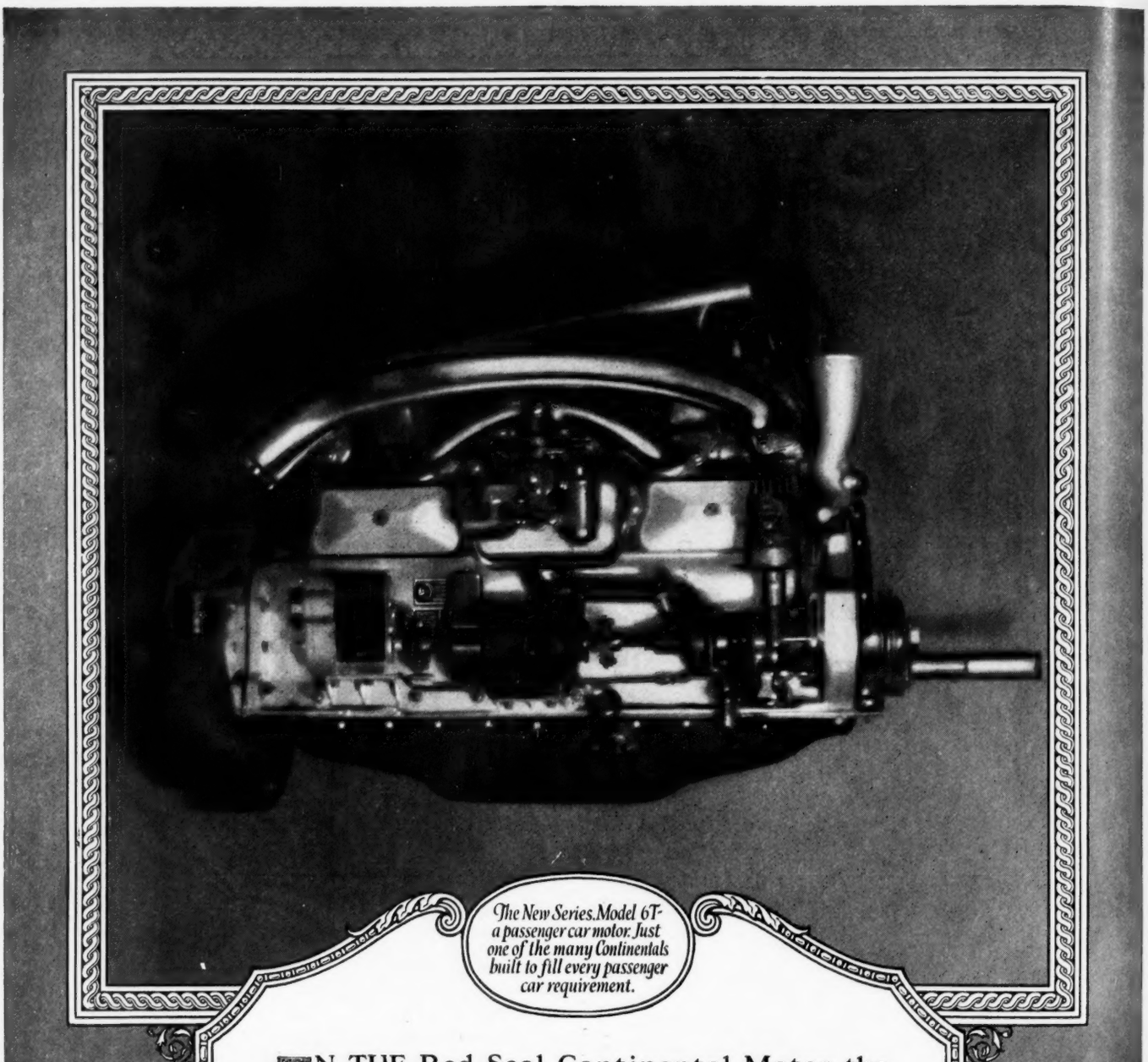

The New Series Model 6T-a passenger car motor. Just one of the many Continentals built to fill every passenger car requirement.

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AUTOMOTIVE INDUSTRIES
The AUTOMOBILE

VOL. XLIX NEW YORK—THURSDAY, JULY 19, 1923 No. 3

Dealer Needs of Major Importance in New Tire Marketing Era

Factory branches are being reduced to a minimum. Warehouses are replacing expensive retail stores. Local merchant becomes vital factor in distribution scheme. Manufacturers striving for conditions under which all sales can be made at a profit.

By Norman G. Shidle

THE dealer has become the most important factor in tire distribution. He influences buying more strongly every year and is now a potent force in determining the success or failure of manufacturers' marketing plans. Tire factories have recognized the growing influence of the independent retailer and readjustments are being made in organization and policies all along the line. The automobile dealer is coming in for more favorable consideration as part of the tire distribution scheme and improved conditions are encouraging him to sell tires as an essential part of a complete line of automotive equipment. A general feeling exists that the best tire merchants are those who sell other automotive products.

Tire builders who once depended strongly on branches to make retail sales in cities are discontinuing their factory-operated retail establishments and are relying on the independent dealer to a greater extent than ever before. This trend has developed a need for certain changes in the relation between tire manufacturers and tire dealers.

The dealer viewpoint must be considered more fully in establishing tire merchandising practices if marketing costs are to be reduced and a stable demand is to be built up. Tire selling has become an unprofitable business for many dealers. Immediate needs of the tire manufacturer rather than dealer necessities have dictated marketing policies in many cases. Consequently a large number of good merchants either have stopped handling tires altogether or have failed to push them as hard as other lines of automotive equipment.

The history of tire distribution indicates that the dealer was a minor consideration for many years, even though many favors were extended to him. Credits were given to dealers for sales made by branches, dealers were not required to carry stocks, and other favors of like character were done for tire retailers in the early days of the industry, but little effort was made until recent years to build them into sound, self-supporting merchants, interested in selling tires because they could make money out of them on a legitimate business basis.

MANY tires have been, and still are, marketed through distributors, but for a long time the larger companies put their faith in factory branches, established in all of the important cities of the country.

A brief résumé of the rise and fall of the tire factory branch is necessary to a proper consideration of the present trend toward a new era in which the needs of the dealer are being considered fully as a means of obtaining greater ultimate benefits for the tire manufacturer.

Twenty years ago important companies usually marketed tires through branches which sold at retail as well as wholesale. Dealers outside of the large cities usually telephoned or telegraphed small orders to the branch and had five or ten tires delivered as they needed them. There were few city dealers, because the factory branch took most of the city business.

AS the number of automobiles increased the branch found itself unable to handle all of the business. Dealers appeared to be necessary. Competition was keen and to get merchants interested in a tire line many concessions were made. They were not required to carry stocks. When a customer came in and wanted two tires the dealer telephoned over to the branch and the latter sent a truck over with them. Perhaps the dealer simply sent the customer around to the branch and then telephones the branch to credit him with the profit on the sale. In an attempt to keep the dealers in line, the branches began to credit dealers with sales made to customers living in the dealer's territory. Thus dealers would get a check at the beginning of each month as profits on tires which they did not even know had been sold.

The unsound character of such practices became evident very rapidly, and finally new methods were employed. It was obvious that dealers would never become real selling forces so long as the factory branch rendered all of the service and passed over the profit to the dealer.

The next step was to eliminate retail selling from the work of the branches. This was done to help build up real dealer organizations in the large cities and to get away from some of the unsound practices and evils which had rapidly developed.

Retail selling from branches had necessitated expensive retail locations, usually in automobile row or some similar place. When retail selling at branches was discontinued these expensive locations were retained in most cases, resulting in high overhead and large selling costs.

THE next noticeable trend resulted in moving the branches from the executive retail locations. This trend is going on today. A strong tendency exists to reduce the number of actual factory branches to a minimum and to establish factory warehouses in their place.

This trend is giving the dealer greater importance in the tire distribution scheme than he has ever had before. Previously the factory branches were depended upon to do a large part of the retail business, or at least to provide considerable prestige and advertising value. Under the new conditions of distribution the dealer becomes the focusing point of the entire selling effort. Advertising, general publicity, sales helps, and all other aids to merchandising center about him. In his strength lies the strength of the tire manufacturer; in his weakness lies the failure of a factory marketing policy.

This brief outline of factory branch history necessarily has been painted in broad strokes. The various periods designated merged into one another almost imperceptibly. There was no clean-cut ending of one practice and beginning of another. But the rough survey is sufficient to present a general picture of the growth from which future selling methods must be developed.

The increasing importance of the dealer in tire marketing is the outstanding fact of the current trend. One tire executive said recently that "the dealer has become more important in tire selling than in the merchandising of any other automotive product."

A tire retailer must have an opportunity to get a sufficient amount of profitable business to make it worth his while to push sales. He must have enough territory without competition to make tire selling an interesting proposition.

GRANTING exclusive territorial rights is not feasible in many cases, but it is necessary to keep two dealers for the same tire sufficiently separated so that each one has a reasonable chance to make profits and so that cutthroat competition is not encouraged.

Tire sales do not vary directly with the number of dealers. This has been proved time and time again in areas which have been overpopulated by dealers selling the same tire. Excess representation encourages price-cutting and demoralization of the retail market. It makes profits impossible for any dealers in the territory and finally results in lack of interest in tire sales on the part of the retailer.

Most tire manufacturers say that they do not put more than one dealer in a given area so long as they have a good dealer who is getting "a proper share of the business." This "proper share of the business" is determined, of course, by the tire manufacturer and sometimes gives the appearance of being a bit arbitrary in character.

Total market possibilities in a territory can be determined rather accurately, of course, on the basis of the number of cars registered. By closer examination of the registration lists it would seem possible as well to determine approximately the requirements for each of the various sizes of tire.

But to say definitely what proportion of that total business should go to a particular manufacturer in a given year is a bit more difficult. Past records are helpful, of course, but the tendency to push sales to the limit often results in every company in the field expecting a larger share of the business each year. This is impossible, of course, since a larger proportion for one maker means a smaller proportion for some others.

EVEN with these difficulties, however, it would be possible to find out with some degree of accuracy what percentage of the business a particular company might reasonably expect to do if past trends and current conditions are used as a basis for computation.

Factory production capacity is often used as the basis for setting quotas, however, with the result that a dealer is expected to sell the number of tires the factory would like to get rid of in his territory, rather than the number that he might reasonably be expected to dispose of on the basis of a market analysis.

The branch manager or the factory salesman usually is responsible for judging dealer performance and for

THIS is the fourth of a series of articles discussing marketing trends in the tire industry. This article tells about the growing importance of the dealer in the scheme of tire distribution and shows how changed policies are being developed for his benefit.

Previous articles in the series were:

"Revision of Marketing Methods Needed in Tire Industry" May 24, 1923

"Spring Dating Should be Banished from Tire Marketing" May 31, 1923

"Make the Tire Business Profitable for the Dealer" June 7, 1923

determining whether or not more or less dealers are needed. Probably he has factory statistics as a basis for judging performance. Perhaps he uses them; perhaps he doesn't. He does know that the factory expects him to get rid of a certain number of tires in his territory within a given time. Frequently he finds it very difficult to know whether to get another dealer to replace the one he has, to add another dealer, or to let things stand as they are in the hope that the present retailer will "buck up" in the near future.

So many dealers have been put into certain territories in the past that business has been unprofitable for all of them. At the same time some other areas have been neglected to a large extent. Comparatively little scientific analysis has been given to the relation of the number of dealers to volume of sales. More detailed work along this line is essential to future merchandising progress.

In the meantime a rule-of-thumb policy, based on sound logic, may work out well. The factory has it within its power very largely to create conditions under which the dealer can make money. It can provide ample territory, proper discounts, fair treatment on price increases, opportunity for commercial account sales, freedom from competition with special brands, useful local advertising, and dealer helps of various kinds. When a factory has done its share to provide these profit-making conditions, the dealer has it within his own power to determine how much money he shall make from tire sales.

IF, under these circumstances, the dealer does not make good profits, he is probably not the right man. If he does make profits the total of his sales is likely to be a very good indication of how much business the particular manufacturer ought to get in that territory. The dealer who finds it possible to make a fair profit on ten tires will not be content until he has made the same profit on as many tires as he can possibly dispose of. A profit on every sale is the most potent sales booster in the world. The only dealer who continually has to be pushed and urged to sell more tires is the one who is working under unfavorable conditions which make it difficult to realize a good profit on the tires that he does sell.

Dealers are merely human. They don't get up much enthusiasm for stocking a lot of tires and then trying to get rid of them when a man in the same block has stocked enough to supply the territory and has to get rid of his, too.

As the influence of the dealer increases, a stable retail organization with a low percentage of turnover is more necessary than ever. A group of soundly financed, able dealers, becomes not only desirable, but essential. Tire companies will have to dig up dealers capable of getting real distribution.

Many good retailers are already selling tires, but not enough of them have been lined up thus far. First-class dealers usually are difficult to get, but a particularly good field for exploitation lies open for the tire factories at this time. There are thousands of passenger car and automotive equipment dealers throughout the country who have not been handling tires in the past for one reason or another. The facilities provided by these men offer an excellent channel for the distribution of tires.

The man who handles tires as part of a general line of automotive equipment is better able to keep his business on an even keel from year to year than is the retailer whose entire funds are tied up in a single product. If tire sales slump temporarily he can keep his head above water with profits from sales of other equipment. He doesn't have to dump his whole tire stock on the market at 50 per cent off list price as soon as the economic sky gets a bit cloudy. He is financially capable of operating his business in such a way as to have a stabilizing and hence beneficial effect on the retail tire market.

Passenger car dealers are handling a wider line of automotive equipment every year. They are realizing more fully the benefits of having something to sell when car sales fall off temporarily. Their organizations are putting real sales effort behind tire lines and are making good profits in this way.

WITH reasonable territorial protection car dealers are selling tires in large numbers to owners of every make of car. Handling a complete tire line provides a good means of contact with the owners of rival cars. The salesman who sells a tire is likely to develop a new car prospect. Consequently tires are being pushed actively by car dealers in many towns. The dealer is making money and the tire manufacturer is getting maximum distribution.

Through his service station the passenger car dealer has a constant and automatic contact with car owners. This gives him an additional opportunity to sell tires. Relatively speaking, he is a well financed retailer. When he handles a tire and automotive equipment lines he puts himself in a highly favorable position.

The automotive equipment dealer who does not handle a car or truck also makes a good tire merchant. The very nature of his merchandise makes it necessary for him to have daily contact with car owners. His business consists of thinking up new ways to promote the sales of automotive products, including tires, and he draws many people to his store because of the variety of things he has for sale. His salesroom is more attractive to the average buyer than that of the exclusive tire merchant.

Past experience shows rather clearly that tires cannot be sold successfully as part of a general line of merchandise such as drygoods or hardware. The retailer who is unfamiliar with automotive equipment has no interest in the product after he has made the original sale.

Service of various kinds is essential to successful distribution of tires. The automotive dealer cannot be expected to take much pleasure in giving service on tires sold by a department store across the street. The department store cannot render the service. Consequently it is incapable of fulfilling the essential functions of a retail distribution agency for tires and other automotive equipment.

A NEW era dawning in the tire industry reveals a changing point of view among tire manufacturers as regards marketing policies. The tire factory was once the starting point of all marketing considerations. Other factors in the distribution scheme were expected to conform more or less to the immediate requirements of the factory.

The dealer is the new starting point from which marketing policies are being developed. The manufacturer with the most able and permanent dealer organization bids fair to lead the field in profitable sales over a period of years. Consequently the things required by the dealer to produce profitable retail sales have become of primary importance. The questions involved in providing such conditions have been clearly visualized in recent years and their solution must be worked out in a practical and constructive manner.

New Mechanical Gearshift Eliminates Levers in Front Compartment

Gears are picked by pre-selector device on steering wheel. Actual shifting accomplished by latter part of clutch motion. Pull rod extending back from instrument board furnishes control for hand brake. Appliance applicable to any make of car.

A MECHANICAL gearshift operating in conjunction with the clutch pedal has been put on the market by the Sector Gear Shift & Mfg. Co. of Detroit. The shifter is designed to be applicable to any make of car, and operates with a pre-selective device controlled by a hand lever on a sector mounted on the steering column. Operating this lever sets the gear-shifting mechanism so that it operates automatically when the clutch pedal is depressed and again released. The clutch may be released in the ordinary way, when desired, without changing gears, as the gear shifting is not effected until after the clutch pedal is fully depressed. While driving, any gear may be pre-selected either while the clutch is engaged or during any phase of the downward movement of the clutch pedal.

To clear the front compartment of levers, an installation has also been worked out for the hand brake to operate from the instrument board by means of a direct pull through a pulley mechanism.

The mechanical operation of the sector gearshift is effected by the lever *A*, Fig. 2. This is set to a notch on sector *D*, corresponding to the gear to which it is desired to shift. This places the pre-selector mechanism, Fig. 3, in a fixed position, opening one side of the hinge, moving lever *E* and compressing spring *F*. This movement does not act on the transmission. The clutch pedal *B*, Fig. 4, is pressed down.

The first half of this downward motion of the pedal forces the cam *H* under the clutch roller *J*, releasing the clutch. At this instant the cam plate stop pin *K* engages the lower lever *L*. On the last half of the downward movement the clutch roller rides on the flat of the cam, holding the clutch out. Forcing lever *L* down compresses gearshift spring *M* and at the same time draws ball lever *N*, Fig. 5, down out of the lock plate *O*, rendering it free to travel horizontally across the slots of the shifting toggles *P*. The pre-selector *F*, Fig 3, will then close the hinge, forcing the lever *G* to the corresponding new position, as, for instance, first speed. On the first half of the return movement of clutch pedal *B* the gearshift spring *M*, Fig. 4, forces shifting toggle *P*-1 down, swinging yoke *R*-1 forward, sliding the gear into mesh. On the last half of the return motion of clutch pedal *B* the cam stop pin *K* is disengaged from the lower lever *L*, and the clutch roller *J* rides down the cam plate *H*, allowing the clutch to engage.

The gearshift levers are polished aluminum. Lever *A* operates above sector *D* and plunger *R* slips into the various notches, holding the lever into position on the sector, as shown in Fig. 2.

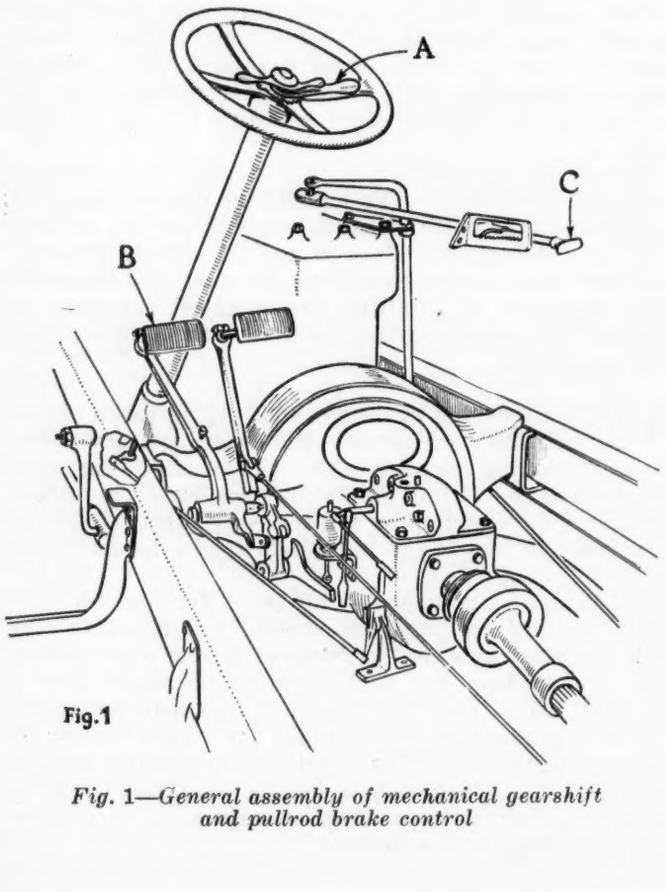
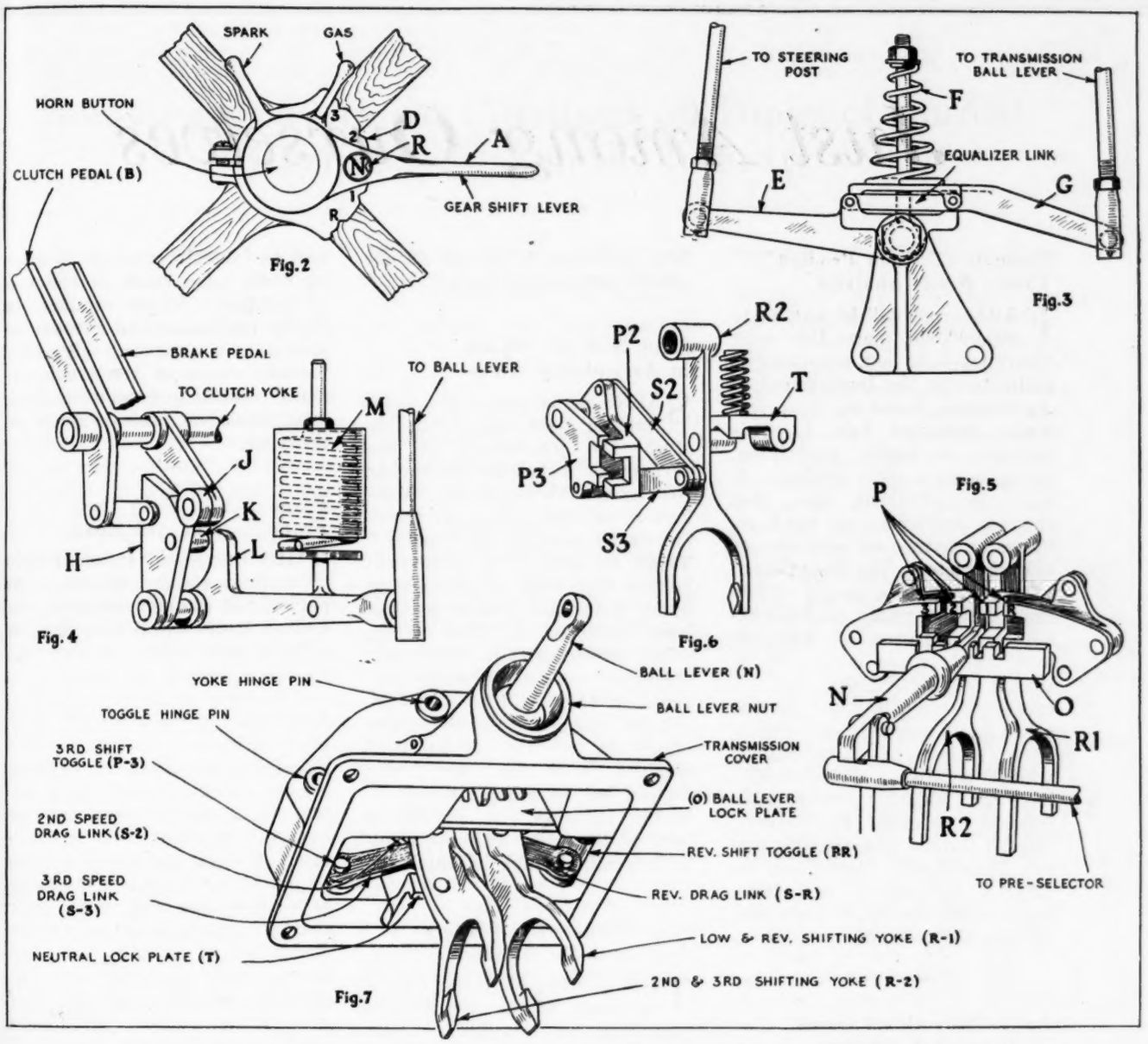


Fig. 1—General assembly of mechanical gearshift and pullrod brake control

Construction of Pre-selector

The pre-selector, Fig. 3, is a double hinged mechanism. A rod is drawn through the complete assembly with a spring on the far side holding the levers *G* and *E* together. As lever *G* is free to travel only when the pedal is fully depressed, the movement of lever *E* opens one side or the other of the hinges, compressing spring *F* in proportion to the movement of the gearshift lever *A* on the steering wheel. When the clutch pedal is fully depressed, the ball lever is free to travel across toggles *P* and the pre-selector spring *F* will then close the hinge, forcing lever *G* to new position. As lever *G* and bell crank *N* are directly connected by means of a rod, the ball lever will move to the new position as pre-selected on the wheel.

The method by which the yoke shifts the gear into mesh is shown in Fig. 6. The shorter ends of the shifting toggles are connected to the yoke by means of two drag links, *S*-3 for third gear and *S*-2 for second gear. The longer ends of these toggles are slotted and the yoke is held in its neutral position as illustrated by the neutral lock *T*. These slots are in line, thus forming a continuous horizontal groove, so that the ball lever *N* is free to travel to any slot selected. The downward movement of toggle



2—Gearshift lever and sector on steering wheel. 3—Preselector assembly. 4—Clutch pedal assembly. 5—Inside assembly of transmission cover. 6—Yoke and toggle assembly. 7—Transmission cover assembly

P-3 will cause yoke *R*-2 to swing back, sliding the gear into the third speed position. The downward movement of toggle *P*-2 will swing yoke *R*-2 forward, sliding the gear into second speed position. The complete cover plate assembly which is bolted to the transmission in place of the hand lever support, is shown in Fig. 7.

Vienna Technical College Tests Endurance Limit For Metals

A SERIES of experiments was carried on during 1922 at the Vienna Technical College with the object of determining whether there exists an absolute endurance limit for metals subjected to alternating stresses.

The metals experimented with were aluminum, copper and iron, and the results were plotted in the form of curves whose coordinates represented the stress and the number of reversals of stress sustained.

It was shown that even when the number of reversals tends toward infinity the stress necessary to cause rupture does not tend toward zero. For each metal there exists an endurance limit below which the stress may be reversed indefinitely without causing failure.

This resistance to shock and reversal of stress does not depend on the ductility or malleability, but on the elastic limit and the hardness. In other words, the resistance is not a function of the capacity of the metal to support deformations, but rather of its capacity to resist them. For instance, a hardened test piece, although brittle, resists better under these conditions than an annealed one.

Microscopical examinations show that the stresses produce a sliding effect along the crystalline planes inside the crystals. If the stresses are low, these sliding effects ordinarily take place in the regions where the metal is less homogeneous, that is to say, in the vicinity of inclusions, scores, porous spots and impurities. It is even possible to observe a slight increase in temperature at these points, which shows that it is here that the metal is working.

Just Among Ourselves

Estimate of Farm Product Values Needs Analysis

FARM crops will be worth $1,000,000,000 more this year than they were last, according to estimates by the Department of Agriculture, based on the prices which prevailed July 1. This forecast is highly gratifying, but it needs a little analysis. It must be admitted, also, that farmers don't place as much reliance as laymen on estimates of this character. The Department figures that this year's cotton crop will be worth $1,493,000,000, an increase of $494,000 over 1922, while corn will be worth $2,488,000,000, an increase of $690,000,000. On the other hand, wheat is expected to show a loss of $100,000,000; white potatoes, $148,000,000; hay, $288,000,000; apples, $56,000,000; peaches, $11,000,000; sweet potatoes, $24,000,000; and rye, $34,000,000. Additional indicated increases are: Oats, $98,000,000; barley, $13,000,000; flaxseed, $23,000,000.

Losses May Offset Gains in Motor Vehicle Sales

WHEN it comes to a consideration of buying, an increase of $690,000,000 in the value of corn is not likely to offset a loss of $340,000,000 on wheat, white potatoes, apples, peaches and sweet potatoes. The chances are that an unusually large corn crop will result in a lower price before it gets to market. It is apparent that while the picture painted by the Department of Agriculture is rosy, the colors are likely to fade, except as they relate to cotton. There is in prospect an actual world shortage of cotton and growers of this crop probably will be even more prosperous than they have been for the last year. The cotton belt, therefore, promises to supply an excellent automotive market.

Sales Will Be "Spotty" in Agricultural Areas

SALES managers in the automotive field can profitably study the psychology of the farmer as it relates to buying for the next three months. Markets in agricultural areas promise to be exceedingly "spotty." There is substantial reason to believe they will not absorb as many cars and trucks as has been expected. If they don't, other outlets must be found and stronger selling pressure exerted, or there will be a shrinkage in volume. Intensive sales effort in certain agricultural sections will be practically wasted but in others it will be highly valuable. It should be part of the sales manager's job to determine which is which.

New Markets for Trailers Appear to Be at Hand

THE twenty-odd trailer manufacturers of the country are preparing to reorganize their association which was abandoned after depression hit the country in 1920. This is a good time for them to act. State after State is adopting more stringent measures limiting weights and loads. They proclaim that they are determined to save the highways from needless damage. Those States which are peculiarly pestiferous in this respect should offer good markets for trailers. It might be well, also, for trailer makers to study the possibilities presented by the cooperative marketing of farm products. This movement is showing surprising strength. The time is not far distant when many of these associations will own their own truck equipment and when they do it will be logical for them to handle their peak loads by the use of trailers. Farm produce is highly perishable and it must be moved in a comparatively brief period. Some of the truck capacity needed to handle the peak load would be useless much of the year.

Farmers Will Gain Most From Federal Aid Roads

THE Bureau of Public Roads estimates that ultimately 90 per cent of the population of the United States will live within ten miles of a Federal aid highway. In some States the percentage will be as high as 98 and in no State will it drop below 65. The total estimated mileage of this Federal aid system is 187,000. Nearly every town in the country with a population of 5000 or over will be situated on this system. Federal aid roads will be of particular benefit to the farm population and will make their markets much easier of access. Reduction of selling costs and more direct connection with the ultimate consumer are the chief aims of the farmer. With good roads reaching every corner of the nation, his best means for attaining these objects will be highway transport by truck and cooperative selling. This is a movement the automotive industry can well afford to foster.

Detroit Car Companies Now Have Money to Lend

EMERY W. CLARK, president of the First National Bank of Detroit, is quoted as saying that he is helping some of the automobile companies which are customers of the bank to find employment for their surplus funds. He doesn't know a single company which is a borrower. For an industry which was supposed to be down and

More or Less Pertinent Comment on Topics of Current Interest to Men in the Industry

out three years ago, this is a pretty good record. But it's nothing unusual for automobile companies to be lenders and investors. A few of them were loaning money to banks along in 1921. Bank connections of substantial automotive concerns are stronger than they ever were before and they won't have much difficulty in getting the funds they need in any future emergency. While profits per unit may not have been as large in the past 18 months as at some periods in history, the volume of business resulting from fair prices to buyers has kept a stream of cash pouring into the coffers of manufacturers.

Railroad Earnings Are Now on a Satisfactory Basis

NET operating revenue of the Class I railroads of the United States was 6.33 per cent on their tentative valuation in May and in April it was 6.50 per cent. June earnings promise to be almost as good. These figures indicate that when the carriers are operated efficiently and economically they can make a reasonable amount of money. Returns began to rise as soon as the executives got down to brass tacks early in the year and decided to devote all their energies to supplying transportation instead of crying so much about real and fancied wrongs. When the country is even reasonably prosperous the railroads will have all the business they can handle. In this connection it is interesting to note that 250,000 carloads of finished motor vehicles were shipped in the first six months of 1923. New York Central lines alone carried 21,224 carloads in May, or more than ever before in a single month. And finished cars and trucks constitute only a relatively small part of the automotive tonnage given the carriers. They seem to be deriving a pretty substantial revenue from the industry which they "pan" so vehemently.

Proof of Good Service Sells Fleet of Trucks

IN discussing service not long ago, a prominent automotive executive remarked that it is something "many promise but few give," and yet it has an exceedingly practical value. That service will sell has been proved anew by an incident in California. The manager of a factory branch went out to sell a fleet of 32 trucks to a company which had just come into the market. He was told it had been practically decided to buy two more widely advertised makes of trucks. "If you can give us one single outstanding reason why we should buy your trucks instead of other makes, we'll consider your proposition," he was told. The branch manager did some swift thinking. "I can build you a complete truck out of the parts now in stock in my service station," was his answer. "If you can do that, we'll buy your trucks," was the rejoinder of the prospective fleet buyer. The branch manager made good and he sold the fleet of trucks. This shows the importance buyers attach to service.

Dealers Must Make Money if Factories Are to Prosper

OTHER passenger car manufacturers may or may not agree with the merchandising policy of Edward S. Jordan as it relates to dealer profits, but the basic principle of his system is eminently sound. It is that permanent success for the Jordan Co. "depends upon its ability to make money for the dealer." No company can succeed indefinitely at the expense of its dealers. Factories have prospered more than dealers the last year and a half. Dealers have not made as much money as they should, considering the volume of business. This has been due largely to the used car and Jordan has accepted the responsibility of the factory in helping solve this problem. Unless the dealer whips the used car and sells new cars in spite of it, the factory will suffer. The dealer organization, therefore, deserves more than kind words and good wishes in its effort to overcome this menace.

Smaller Companies Straining Themselves to Aid Dealers

WHETHER from necessity or choice, some of the smaller companies have gone farther than some of the larger ones in assisting their dealers, especially in the way of financing. A few of them, it is reported, have taken over so much of their dealers' paper that they have stretched their own resources. The result is that they are being forced to decrease their specifications, notwithstanding the fact that they have more orders on their books than ever before. Their efforts to aid their sales organizations have been praiseworthy even though they may have been misguided. The used car menace can't be cured merely by the expenditure of money. It is a business problem and it must be handled in a business-like way. Cars which have been reconditioned naturally sell more readily and for a higher price than those which have not. This is the basis of the "Jordan plan." He is attempting to establish a definite market value for his used cars. It's not expensive for him and it helps his dealers in a definite way.

J. D.

What Are Fundamental Factors Which Govern Motor Bus Design?

General purpose passenger vehicle is necessarily a compromise calculated to give optimum performance, good riding qualities, least inconvenience to passengers and high operating economy. 2-2½ ton chassis with four-cylinder 40 hp. engine is favored.

By Alfred F. Masury
Chief Engineer, International Motor Co.

BUS design aims at four principal ends, performance, comfort, appearance and economy. That bus is best designed which renders the most satisfactory performance for the conditions of operation, carries its passengers in the greatest of comfort and convenience, with the most pleasing appearance and at the least operating cost. All of these factors are more or less opposed. Maximum performance can be secured only by sacrificing the comfort of passengers, disregarding appearance and at excessive cost. The most luxurious riding can be secured only at the forfeit of performance and economy, though not necessarily of appearance. The most pleasing appearance is not always compatible with the best performance, the greatest comfort and convenience of passengers or economy. Economy alone reaches its acme only when the other three factors are reduced to their minimum. The ideal bus design must therefore be an optimum between extremes in these four directions.

In striking a proper balance between the various factors, we must find the best balance between earning capacity, that is cost per mile. We must further balance this result against passenger convenience by keeping the capacity down to a figure which will permit, with the volume of traffic to be expected, of a headway on the route which will attract a reasonable proportion of the patrons, especially the short-riders. Such a balance will depend very largely upon the conditions obtaining upon the route over which the bus is actually to be operated.

The most suitable size and type of bus for any general classification depends upon the characteristics of the service. It is obviously out of the question for any manufacturer to attempt a custom business, contemplating such infinite variety of product, both because of the excessive cost of construction involved in thus eliminating any standardization and because of the impossibility of servicing such a heterogeneous product.

IT is therefore necessary for manufacturers to study the prevailing requirements as compared with the most economical and efficient types of design to determine on one, two or perhaps three types of buses suited most nearly to the greatest number of bus applications. If one were to select one type of bus, subject only to minor modification, which would appeal to the greatest number of buyers in the present-day market, it would probably be a type adapted to service in the following classes:

Suburban and residential rapid transit feeders
Suburban cross-town service
Trolley line extensions into new territory
Resort and beach lines
Interurban lines
Cross-town service in congested sections of large cities
School, club, hotel and livery buses.

There are several important differences between these services which would seem to require quite different types of buses, but each may be said to be met with moderate success with one basic chassis with modifications in body and equipment, gear-ratios and wheel and tire equipment.

In my view, the best type of bus for the greatest present market is a 2- to 2½-ton chassis, with a frame less than 30 in. from the ground and with the floor laid directly on the frame to take full advantage of its lowness, thus securing a low floor without the sacrifices incident to an excessively low frame. It should be powered with a four-cylinder engine, slightly but not excessively higher powered than its commercial prototype in capacity. The chassis lay-out should be conventional, final drive being through a gear-driven axle. The chassis must be robust and all parts provided with liberal bearings because of the very heavy duty imposed. This entails more chassis weight than in a truck of corresponding capacity—not less. For economy's sake the necessary weight of the chassis must be compensated for by a corresponding elimination of much useless weight in the body.

THIS bus should have springs of much greater length than those used on trucks, these springs being dead flat under load, as wide as practicable and composed of a plurality of thin leaves.

The size of the engine, that is, the horsepower, for any type of bus depends upon the weight of the loaded bus it is to propel, the speed and acceleration which it is desired to secure with it and the road conditions and grades over which it is to be operated. These factors are subject to so much variation that one type of engine may not serve satisfactorily for all types of busses. For the greater number of buses of the type above outlined, however, a four-cylinder engine of between 35 and 40 hp. will prove the most permanently satisfactory. Excessive power may be needed for long, fast routes over hilly roads or where considerable snow, mud or sand is to be encountered, but on most routes an over-powered engine will add uselessly to the first cost, upkeep cost, operating cost and weight of the bus, will take more space and hence either require a longer and heavier vehicle or else restrict passenger space.

For bus service, certain differences in engine characteristics are required as compared to conventional truck or

passenger car practice. A bus engine must be of heavy-duty type, capable of operating at or near its maximum capacity for protracted periods and for from 18 to 24 hours per day, without tinkering or frequent adjustment and without complicated auxiliary, carburetor control or adjustment. It must be capable of cooling satisfactorily under all conditions and must have bearings and a lubrication system capable of allowing it to function efficiently for weeks and months without adjustment or attention. Acceleration and speed in intermediate gears are desirable to a much more marked degree in buses than in trucks. Consequently a flatter torque curve and a power peak at higher speed is desirable. Owing to the higher speeds at which bus engines operate, a pressure lubrication system becomes eminently desirable.

ELECTRIC starting and lighting are necessary, of course, the system for bus use having considerably greater capacity than for motor truck installation. This involves the use of a larger generator and a larger battery, to care for the rather heavy demands of the lighting system during the hours of darkness and of a regulating means of maintaining a high rate of output when the lights are in use and a considerably reduced output during the daytime.

There seems to be little justification for departing from standard, familiar poppet valve construction in bus engines. Modern poppet valve engines, properly adjusted, suffer from very little valve clatter.

Disregarding chain drive, which while highly efficient for truck work is unsuited to bus work because of noise, the best form of drive, according to my view, is the double reduction wherein a primary reduction at high speed is secured through bevels and the secondary reduction, at low speed, through wide-faced spur gears at the middle of the axle. This is because first, such a drive is highly efficient under all conditions of service, has a relatively small number of bearings, and excellent alignment of shafts and gears; secondly, because it is easily accessible when properly constructed, and, finally, because its greatest weight is carried at the middle of the axle, this serving to reduce the extent to which it must be lifted in negotiating uneven roads and thereby making for greater ease of riding.

The double-reduction type of axle, when properly made, is light for a given strength and is silent, especially after extended service. It is reliable because its proper adjustment and condition is indicated by whether it is silent or noisy.

A double-reduction axle is preferably based on a one-piece drop-forged load-carrying member of the banjo type, permitting independent access to the differential, jackshaft or bevel pinion shaft.

Road clearance and top clearance are subjects involving many considerations. With the undoubtedly sound tendency toward smaller wheels, both on solid and pneumatic tired types large clearances become increasingly difficult and the temptation is strong to resort to unconventional types of axle construction in order to reduce the height and depth of the central portion of the axle housing. The greatest incentive to such ventures in design, however, is the desire for extremely low frames and often involves the reduction of under clearances to a radical degree. In this matter of clearances, it must be recognized at the outset that buses inevitably fall into two distinct classes which differ in conditions of operation and structural requirements. Consequently concessions, compromises and sacrifices are permissible in one class of buses that may not be in the other.

For strictly urban operation, where smooth, paved streets, kept clear of snow, are to be used, both under clearance and top clearance may be sacrificed to secure low frames. The sacrifice of under clearance is justified by the fact that the evenness of the road surface renders as little as 4 in. road clearance quite safe. The sacrifice of top clearance is justified by the fact that the smoothness of the road surface permits much less spring deflection to be used than would be necessary on rougher roads, both from the standpoint of ease of riding and from accommodation to extreme differences in the elevation of the four wheels.

In the suburban and intercity type of bus, however, where stops are less frequent, where the number of passengers boarding and alighting at one time averages considerably less and where an upper deck is not to be considered, the extreme lowness of the platform is not essential, while both road clearance and top clearance need to be more adequate. Certainly not less than 8 in. should be provided under the axle at its lowest point and not less than 6 in. above it, at the middle. Sacrifice of the simplicity, durability, accessibility, strength and lightness of conventional types of shaft-driven axles to secure such clearances in combination with an excessively low frame are hardly warranted by the demands of suburban bus operation. If the depth of the central housing of the axle can be held down to 15½ in. a bottom clearance of 8½ in. minimum and a top clearance of 6 in. makes a total of 30 in. for the distance from ground to under side of floor and requires tires of 32 in. outside diameter, as shown in Fig. 1. Tires of 34-in. diameter, as shown in Fig. 2, increase this under floor height to 31 in. This does not mean that the floor need necessarily be that high, however, for it has been found quite practicable to place a stamped metal dome over the middle of the axle protruding as much as 3 in. above the floor height, without inconvenience to passengers. This permits a reduction of the floor height at its upper surface to 28 in. on 32-in. tires, or 29 in. on 34-in. tires.

WITH an axle tube diameter of 3½-in. maximum under the frame and 6 in. clearance between the axle and the frame, and a floor thickness of 1 in., there remains but 4 in. for the depth of the frame at this point, assum-

THIS is the first of two articles dealing with fundamentals in bus design and written especially for AUTOMOTIVE INDUSTRIES by the chief engineer of one of the leading manufacturers of motor bus equipment.

In this article the author deals with considerations which govern the general nature of the chassis, size and character of engine, type of final drive, factors which govern frame height, optimum design and arrangement of brakes and the most favorable type of tire and wheel equipment.

The second article takes up the matter of spring design, dimensions for track and wheelbase, use of Hotchkiss drive and treats briefly the subject of body construction.

Although the views here expressed are the result of long, practical experience in bus design and construction, other engineers may hold divergent opinions on some points raised. AUTOMOTIVE INDUSTRIES will be pleased to receive comments from readers who care to discuss these articles.

ing the floor to lie directly upon the frame—obviously a tight squeeze.

IN view of the limitations imposed by these considerations, it would appear that the minimum frame height over the rear axle, with 32 inch tires, is 28 in., with an under floor height of 28 in. Such a floor height can be reached by two easy steps from the ground, more easily still from a 6-in. curb. Of course there is nothing to prevent a still lower frame and floor ahead of the rear axle, though of course the height of the shaft, the shaft brake, where used, and of the gearset, where this is amidship, comes in for some consideration. With 32-in. tires, the center of the bevel pinion, if located straight in front of the axle, would be about 16¼ in. above the ground. The largest universal used on buses of the size under consideration is 7 in. in diameter, its top being therefore 19¾ in. from the ground. A good shaft brake design can be made with a height of 7 in. above the shaft center, its top being 23¼ in. above the ground.

A gearset for such a bus will have at least 9 in. height above the shaft center, making its top 25¼ in. above the ground. It is thus seen that with a brake or a gearset amidship, the frame cannot be dropped to less than 25 in. from the ground, a drop of but 3 in. below the minimum height over the rear axle. All of this on the assumption that 32 in. tires will be used. The smallest diameter tires now in use to any extent on buses are 34 in. size. Summarizing all of the above-determined dimensions for both 32- and 34-in. tire sizes a set of minimum dimensions for the frame without departing from sound, conservative axle construction are secured:

Distance from ground	32-in. tires	34-in. tires
Minimum height of top of frame over rear axle	28 in.	29 in.
Depth of frame over rear axle	4 in.	4 in.
Minimum height of top of frame over gearset	25¼ in.	26¼ in.
Minimum height of top of frame over shaft brake	23¼ in.	24¼ in.

OF course the frame may be dropped lower than this in front of the rear axle, but, if so, it must drop below the floor if the floor remains level, requiring sills or bolsters or both to prop up the floor, and gaining nothing. The above figures show that the kick-up which is necessary to secure the very lowest floor possible between axles is very slight and the reduction of floor height secured seems hardly worth while. Kicked-up frames are not excessively expensive to build, but they do seriously complicate the service problem, particularly in the smaller cities where the greatest market is to be expected.

Because of the frequent and rather violent application of brakes necessitated by the conditions under which buses operate, these members become a very important factor. The brakes not only contribute to safety, but they exert a very potent influence on average speed. The better the brakes the more quickly a route can be covered. Ability to stop quickly reduces the time consumed in stops and safe, reliable brakes increase the driver's confidence and enable him to accelerate to higher speeds between stops than he would otherwise be justified in doing.

The requirements of bus brakes are: first, effectiveness; second, durability and freedom from the necessity of frequent adjustment; third, good cooling, especially in hilly country; fourth, freedom from trouble due to water, mud, sand, stones, and weeds; fifth, positive action in both directions, and, finally, freedom from skidding tendencies. In addition to these, quietness, ease of application and freedom from grabbing or chatter are eminently desirable.

NEARLY all of these requirements call for adequate size. To secure ample diameter and width of lining, with stiffness of shoes, it is necessary to abandon all thought of double internal brakes of any description. Two brakes cannot share the same drum surface without sacrificing surface; concentric drums require one of them to be unduly small and hence lacking in power and both sets of brakes to be of cramped and flimsy construction. Adequate cooling is difficult to secure where two sets of brakes act on the same drum, particularly where one set operates externally.

For these reasons, wheel brakes, whether front wheel or rear wheel, should be single, internal and fully inclosed. They should be of large diameter, generous width and provided with deep, stiff shoes. The lining, furthermore, should extend only over the effective surface of the shoe, the surface near the pivots or tips of the shoes being unlined, since lining near the pivots does not contact with the drum, while that near the tips, being at the long end of a lever, is applied with insufficient pressure to be effective and serves only as a spacer to keep the effective portions from contacting. Omitting this ineffective lining also gives additional chance for the radiation of heat from the drum.

Durability is the result of adequate wearing surface and effective cooling is an assurance of infrequent necessity for adjustment. Equally important, is the provision of adjusting means at once simple, accessible, easy and proof against vibration. Wheel nuts or thumb nuts with spring poppet locks are easily applied to the brake rods in accessible positions, and when properly designed permit instant adjustment, by hand and without tools.

Skidding is the result of a combination of causes, including faults in the road, the weather, the vehicle and the driver. The road and the weather cannot be controlled by the bus designer. He is more or less helpless as concerns the driver; but he can control the design of the

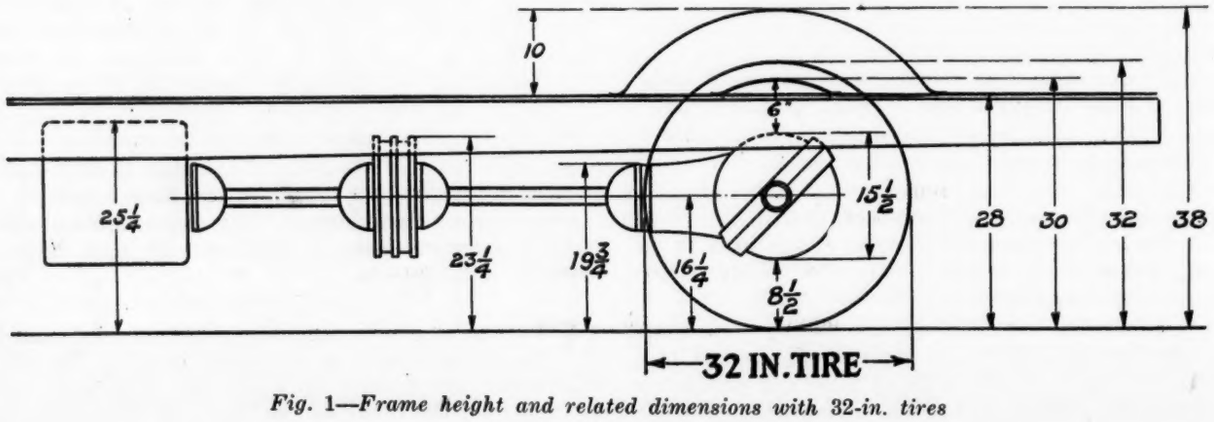


Fig. 1—Frame height and related dimensions with 32-in. tires

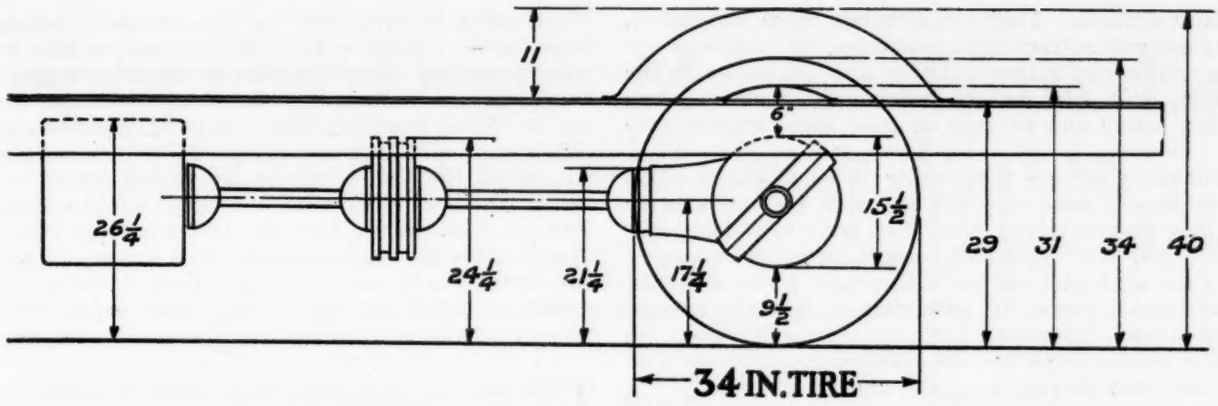


Fig. 2—Frame height and related dimensions with 34-in. tires

brakes to minimize the effect of slippery and high-crowned roads, wet or icy weather and reckless, unskillful drivers.

BRAKES most certainly should be equalized. Brakes on the propeller shaft are perfectly equalized through the differential since the adhesion of the tires to the road plays a most important part in brake effect. The differences in traction between the two wheels can be compensated for only by the differential, hence only a shaft brake can be truly equalized. However, wheel brakes can be equalized so far as the pull on the brake rods is concerned. This is possible with the simplest forms of cross-trees, provided the brake camshaft levers have the same angularity when the brakes are applied and provided the brake rods are of the same length. This type of evener does not produce equal pressure on both brakes, however, when, due to unequal wear, unequal brake rod adjustment or improper adjustment, the different levers and rods in the system get out of a correct relation.

Front wheel brakes are shown to add considerably to the effectiveness of the braking system when used in conjunction with the rear wheel brakes, by adding to the points of road traction through which braking effort can be applied. They are also known, in some instances, to provide effective control of skidding since the front wheels can be guided and hence made to resist skidding more than the rear wheels, which cannot be steered. By themselves, however, front wheel brakes offer little or no advantage and several disadvantages. Except for the ability to guide the front wheels, front wheel brakes offer even more tendency to produce skidding than rear wheel brakes since the retarding force is applied ahead of the center of gravity of the vehicle. They certainly complicate the vehicle and especially the steering knuckle arrangements. They add to the unsprung weight of the front axle, and unless great care is used in their design they are apt to be uncertain in action when the wheels are turned.

GREAT advances have been made in front wheel brakes within the past few years, which provide an opportunity to study various schemes. Those schemes which rely upon a brake rocker shaft operating through a universal joint, some above the center of the steering pivot and others elsewhere with a telescopic shaft, have proved to have rather serious drawbacks, notably the unreliability of the brakes when traversing rough roads or turning, due to the twisting effect on the shaft occasioned by deflection of the joints, the difficulty of preventing excessive lost motion and of properly inclosing the parts. Some of these have been made to impose additional duty on the shafts by mounting one end upon the brake flange, the other on the frame, thus requiring it to compensate for the movement of the frame in relation to the axle as well as the turning of the wheel in relation to both. The most practical design seems to be that in which a rigid shaft, mounted on or in the axle forging, operates a vertical plunger through the center of the steering knuckle pin by means of a rocker arm.

Where front wheel brakes are simply used as a secondary set, supplemented only by rear wheel brakes, they should be as nearly as possible similar to the rear wheel brakes and equally effective.

CONSIDERING the matter from a standpoint of fundamentals, it seems that front-wheel brakes are a desirable thing on buses though of questionable value on motor trucks or ordinary family cars. A development which gives much promise is the so-called servo type of brake, in which internal shoes are so hung in their drums that they take on the characteristics of the self-wrap flexible band brake, providing very sensitive control and great effectiveness with only very light pressure on the operating means, most of the pressure being secured from the motion of the brake drum. Usually, such brakes will not work in the reverse direction and hence can not be relied upon for use independently. Requiring so little effort on the part of the driver, they can be connected up with either of the standard rear-wheel or shaft braking systems without adding appreciably to the effort necessary to operate them, and hence but little to the slack necessary. Such a combination is particularly desirable in connection with a shaft brake because the latter permits but three clearances to be used, instead of four and because a shaft brake requires only moderate operating pressure because of the favoring gear-reduction through which it works.

Such a servo brake, therefore, operated by a steering knuckle plunger, through a rigid rocker arm and shaft carried by the axle forging and connected by conventional brake rods, through a three-way evener to the shaft brake should make a powerful, easy and skidless brake ideally adapted to foot application, the rear wheel brakes being operated by a hand lever.

At the present state of the art, the cast steel, spoked type seems to be well adapted and popular for solid or cushion tires, though it is only lately that they were obtainable generally for 34-in. sizes. For pneumatic tires, the steel disk wheel seems to provide satisfaction, though considerable development along this line is to be looked for.

In our experience the most satisfactory tire equipment for buses is the cushion solid type, of which a number of good examples might be cited, some having air spaces in the core of the tire and others large depressions at the sides for the same purpose, that is, to provide room for the rubber to flow.

Cushion tires are somewhat more costly than solids, but they are also longer-lived and it is doubtful if, on the sizes of buses we have under consideration, their cost per mile

is greatly different. They are certainly more economical, as they not only attract more patronage, through superior silence and ease of riding, but they also are easier on the pavement, and cushion the mechanical parts against vibration better and so save at least some maintenance cost.

Pneumatic tires are a necessity in some cases. They are considerably more expensive to install, they are shorter lived, they cost more per mile, they are less reliable, are less safe and not appreciably easier riding on ordinary roads than cushion tires on well-sprung buses equipped with additional means to effectively absorb the minute road vibrations. Pneumatic tires are a necessity wherever soft sand, mud or snow is to be traversed to any extent or where the road surface is rough and rocky.

Three types of pneumatic tire equipment are used on buses of the type under discussion, viz: the so-called giant truck tires, of large diameter and cross-section, 36 x 6 in. fronts and 42 x 9 in. rears; the dual rear arrangement, in which all tires are 36 x 6 in., and the new doughnut or balloon type tires, 32 x 6 in. front and 32 x 6 in. dual rear.

THE giant pneumatics are less popular today than they have been, principally because of the higher cost per mile of such tires, and their excessive diameters. The cost per mile is higher in the long run than solids and their excessive size in the rear raises the body too high for present operating demands. Their great size and weight and the high pressures to which they must be inflated also renders them exceedingly difficult to repair, and makes it almost impossible even to change them on the road without at least two men to do the job. A blow-out with such tires, if running at any considerable speed is apt to prove serious.

Dual pneumatics have come into increased popularity, of late, especially for bus work, as they permit one spare tire to serve for all wheels, the tires are easily handled and improvements in wheel and rim construction have made it a comparatively simple matter to effect changes. However, dual tires still suffer from the disadvantage of injury due to stones becoming lodged between the tires and the difficulty of detecting punctures. If one tire of a pair is punctured, the load is all thrown to the other, with the result that both tires stand up fairly round and there is nothing to reveal the fact that the remaining tire is sustaining a 100 per cent overload until severe damage to it and perhaps a blow-out results. Even 36-in. pneumatics raise the frame 1-in. higher than 34-in. solids or cushion type tires and the wheel box must be made 1 in. higher.

THE doughnut tire, while still in the trial stage, promises avoidance of the disadvantages of both the giant and the twin pneumatic, since it may develop to the point where it can sustain the rear wheel load on a single tire, as does the giant, but still be made of the same or smaller diameter as the twin, to weigh but little if any more and to carry about the same inflation pressure.

There have been a few problems with regard to wheel, rim and brake drum construction, but their solution has not been as difficult as was at first anticipated. It seems to be pretty well agreed that "balloon" pneumatics do offer better traction than either of the other two types, since their lower inflation pressures result in a larger road contact area. They have shown astonishing mileage life, so far, and they are easier riding than any other tire equipment. If this type of tire continues to show these advantages and does not develop other and unforeseen drawbacks, it should certainly increase the attractiveness of the pneumatic tire for bus use.

The cushion tire, however, still possesses the advantage of economy and reliability for operation on smooth streets at moderate speeds, such as found in built-up communities.

Honing Machine Developed for Finishing Cylinder Bores

IT has been a matter of common knowledge among tool makers for years that no surface can compare with a lapped or honed surface, and a few concerns have adopted this method of finishing their cylinders, getting quite remarkable results. The Moline Tool Co. has recently placed a honing machine on the market as a solution of the problem of finishing automobile cylinder bores.

The machine has the same general characteristics as the "Hole Hog" multiple drillers and cylinder borers produced by the same company, the principal difference being that the spindles can be reciprocated up and down as rapidly as desired, while the laps are being revolved.

The No. 5 machine is built with a stationary rail and sliding table, customer's crankshaft and connecting rods being used to reciprocate the spindles, giving nominally the same stroke as that of the engine, but this can be changed to give a greater or lesser stroke as desired. The cylinder block is mounted on a proper fixture on the table, after which the entire unit is raised from the loading to the working height. In doing this, the lap-closer block is raised above the laps, permitting the latter to enter the cylinder. The table is regularly elevated by a hand wheel through spur gears and rack pinion, but power elevation is furnished as an extra. The relation between the rotation and reciprocation of spindles is controlled by slip gears. The machine is furnished with pump and piping and the necessary holding and locating fixture.

Views differ as to the best method of lapping, some preferring rapid revolution and slow reciprocation, and others rapid reciprocation and slow revolution, or even indexing. Any desired relation between rotating and reciprocating speeds can be obtained on this machine.

The machine is arranged with a clutch pulley which can be driven from a countershaft, direct from a motor or from a line shaft.

To meet the demand for a more universal lapping machine which will handle any type or size of cylinder by simply changing the center distance of the heads and the stroke, the manufacturers have brought out a machine similar to their general line of sliding rail type machines. The rotation of spindles is obtained through spiral gears, in the same manner as on their standard machines, and the reciprocation of the rail is through a rack and pinion, a nest of bevel gears and clutches. Any stroke or position of stroke with respect to the cylinder block can be obtained by setting the stops to suit. When the honing operation is complete the hones are withdrawn automatically.

New Spring Design Makes Master Leaf Thinner Than Shorter Plates

Conventional practice revised to reduce probability of breakage. Leaves are tapered and nip is kept at a minimum. Construction of Landau High Endurance product claimed to insure uniform distribution of stress throughout mass of material.

"ANY plate in a plate spring, except the shortest one, acts as a cantilever fixed at one end, loaded at the other and having a flexible support somewhere between." This is the first principle laid down by David Landau, designer of the High Endurance spring, in explanation of his theory of the mode of action of spring plates. His exposition follows:

If two flat plates be laid together and clamped, as shown in Fig. 1, and then loaded at the end of the longer plate, as shown in Fig. 2, it will be found that when this system of plates is deflected the short plate touches the longer one only at the point of anchorage and at the tip, as shown diagrammatically by Fig. 3. This gives the first principle stated above.

Let us see what load can be carried safely by this two-plate spring. Referring to Fig. 4, suppose that this single plate of length $2l$, width b and thickness e, has been found by experiment to be capable of supporting safely, say, 100 lb. at its free end. It then follows, from the principle of bending moments, that if we had a plate of similar material and of one-half the length, it could support a load of 200 lb. at its free end; this is indicated by Fig. 5.

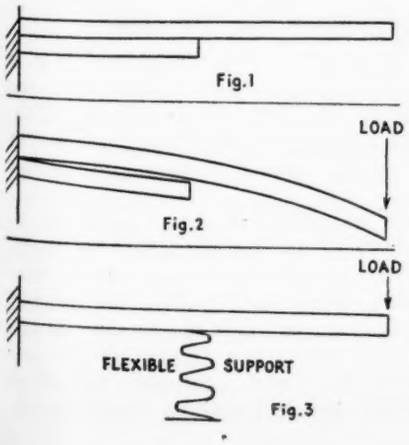
Suppose we now combine the two plates of Figs. 4 and 5 so as to form a two-plate spring as shown by Fig. 1, and see what safe load we may put on the free end of the master leaf. It will be seen at once that the pressure at the tip of the short plate will, probably, be higher than the load on the end of the main leaf. Now, it may be shown by calculation and verified by experiment that if we put 160 lb. on the free end of the main leaf we will have a pressure, or reaction, of 200 lb. on the tip of the short leaf. We have already seen, however, that this is the maximum permissible safe load that the short leaf may carry, so it follows that the maximum safe load which the two plate spring may support is 1.6 times that of a single plate spring. According to the older theory of plate springs, based on the assumption that the plates contact everywhere when loaded, such a two-plate spring could safely carry double the load of a single-plate spring.

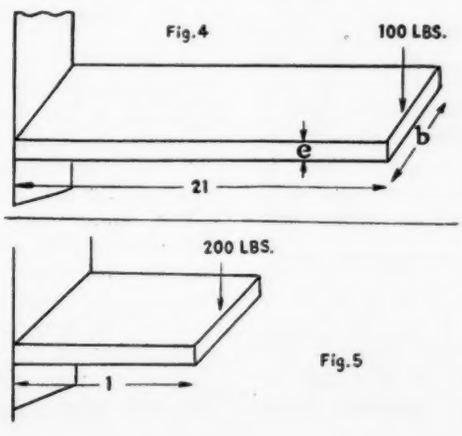
Let us now find the stresses in these plates. If we plot the bending moment diagram of this two-plate system, as was done in Fig. 6, it will be seen that in the short plate the stress increases from zero at the free end to a maximum at the point of anchorage, while the stress in the master plate increases from zero at its free end to a maximum at a point directly over the tip of the short leaf, from where on it decreases very slowly to a lower value at its fixed point. The maximum stress in the master leaf is seen to be only 4/5 that in the short plate, while the stress at its fixed point is only 3/5 that in the short plate at the same position. Since the cross section of the leaves is constant, the stress is proportional to the bending moment. Now, the maximum bending moment in the short plate is Pl, and the bending moment in the master leaf at the tip of the short leaf is $4/5\,Pl$, whereas at the point of the main plate the bending moment is

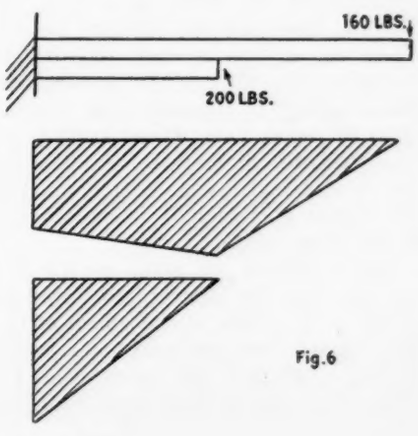
$$4/5\,P2l - Pl = 3/5\,Pl$$

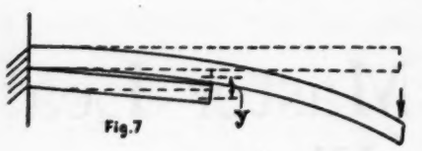
Test of Pressures on Plates

That the pressure between the two plates is as indicated may be easily proven experimentally as follows: Arrange the two plates as in Fig. 7, place any load P on the main leaf and note the deflection y of the short plate. Now remove the load P, dismount the plates and load the short plate *alone*, until its deflection becomes y as before. It will be found that this load is $5/4\,P$; that is to say, the load acting on the end of the short plate was 25 per cent more than that placed on the end of the main plate of the









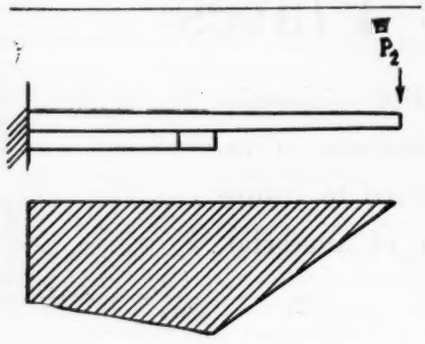
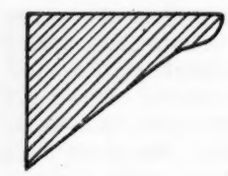


Fig.8



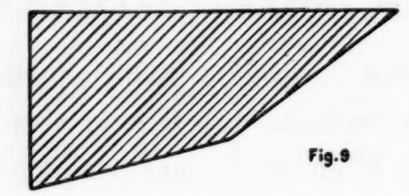


Fig.9

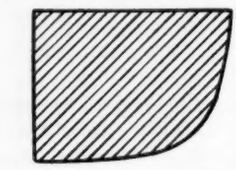


Fig.10

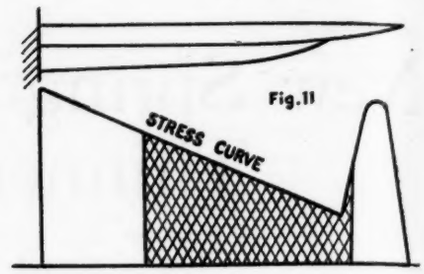


Fig.11

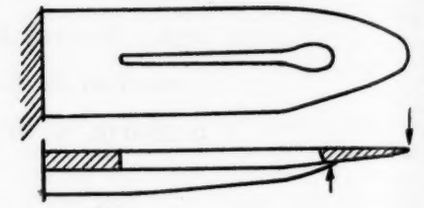
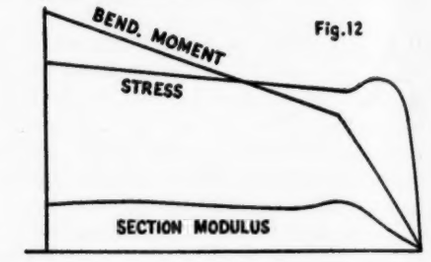


Fig.12



two-plate spring. Putting this in another way and considering the safe load on the short plate as unity, to obtain this unit load, or reaction, we can put only 4/5 of it on the main plate.

Cause for Short Plate Breakage

Since the short plate is only half as long as the main one, the relative load that it will support is double that of the latter. The main plate load that will create this pressure on the short plate can only be, as we have seen, 4/5 of it, that is to say 4/5 of this double load, or 8/5. Summed up, this is equivalent to saying that the two-plate spring, made of two plates of equal thickness, can carry safely only 1.6 times the load of a single plate spring. Similar reasoning would show that a three-plate spring can carry 2.207 times the load of a single plate spring and a 10-plate spring, made in the usual way, with the long plate of the same length as the master leaf, can safely carry only 6.781 times the load of a one-plate spring.

It is impossible to make a spring with leaves all of the same thickness and not tapered, so as to have uniform stresses throughout. In a spring of this kind the stress becomes smaller and smaller in the succeeding longer leaves. From this it follows that the stress in the short plate becomes relatively higher as the number of plates increases. We have thus the explanation of the frequent breakage of the short plate.

Now, how can we account for the phenomenon, often observed, of the master leaf breaking first? That the breaking of a master leaf is considered a serious practical disadvantage is attested to by the fact that in the cheaper class of motor cars whose springs are often made of carbon steel, the master leaf is often made of alloy steel. If the master leaf breaks first it must be due to the fact that the stress at which it is operating is greater than that in the short plate.

Fig. 8 shows the same spring as Fig. 6, with the exception that the short plate is tapered (we have shown a taper in the plane of the width of the leaf, but the following remarks are applicable to a taper in any plane). It is evident that with any given load on the tip this tapered short plate will deflect more than one not tapered. Now, since this leaf has the same cross section at the fixed point, the safe load which it may support will remain the same, namely, 200 lb. The bending moment diagram of this short plate is the same as that of Fig. 6, but the stress distribution is quite different. The diagram here shown for the short leaf is a stress curve plotted to the same scale as the bending moment diagram of the short plate of Fig. 6. Since the main plate is not tapered, its bending moment diagram may also be looked upon as a stress diagram; compare this with the main plate diagram of Fig. 6. Now, what load P_2 must we place on the end of the main leaf of Fig. 8 so as to give a pressure of 200 lb. on the tip of the short one? It is easily shown, either by calculation or experiment, that the load P_2 will now be greater than the 160 lb. which we had in the first instance. How much greater than 160 lb. this load will be will depend on the characteristics of the taper of the short plate. Suppose that, instead of P_2 being 4/5 of the reaction on the short plate, it is 9/10 of it; we thus arrive at the apparently curious result that—in any plate spring, if one of the shorter plates is tapered, the load on the plate above must be increased in order to obtain the same pressure (reaction) on the shorter plate and, of course, on the spring as a whole. Therefore, tapering, within limits, is one of the most important means of increasing the safe load that a plate spring may carry.

Tapering Introduces New Problem

If the taper is made longer, P_2 will increase, and if it is made long enough P_2 will attain a higher value than the safe load on the short plate, as illustrated in Fig. 9. This, of course, will cause the master leaf to break first, and it also explains the much rarer case of intermediate plates breaking first.

The reader may take exception to this statement, in view of what was said in the third paragraph of this article. It was there stated, in effect, that the load P_2 was less than the reaction, and we are now stating the inverse. It should be remembered, however, that the conditions are quite different in the two cases; the following physical illustration may clear up this point. Suppose the short plate was infinitely flexible (had an infinitely "fine" taper),

then it would sustain only an infinitely small load (reaction) for an infinitely large deflection. In that case the reaction would be practically zero and the load on the main plate, whatever its value, would, in comparison, be infinite. Where there are a large number of plates in the spring it may happen, owing to a combination of taper and nip, that some of the intermediate plates are the most highly stressed, and this explains the much rarer case of intermediate plates breaking first.

It will thus be seen that when we attempt to taper the leaves of a spring we at once meet with a new problem, that of the correct taper for a spring. This will be dealt with later on.

When a leaf spring is manufactured the various leaves are generally given different radii of curvature, the shorter leaves being formed to smaller radii than the longer ones (Fig. 10). When plates thus fabricated are assembled to form a spring, each of them will undergo a deflection in either a positive or negative—down or up—direction, with the result that there will be produced an initial stress in each of the leaves before any load is put on the spring. These initial stresses are called nip stresses.

Nip Increases Life of Short Leaves

As may be seen from Fig. 10, the nip puts an initial positive load on the shorter plates, thus augmenting the stress in these plates, and in the case of the longer plates, since the deflection produced by the nip is opposite to the load on the spring, the nip reduces the stress in these plates. There may also be some plates, or at least some section of a plate, in which the nip stress is just balanced by the load stress, so that these plates may have areas of zero stress. We thus see that nipping gives us a means of reducing the probability of breaking the main leaf, the use of which unfortunately is accompanied by the drawback of decreasing the life of the shorter leaves. Still, we have thus a means of offsetting, in a measure, the effect of improper tapers, which tend to cause the master leaf to break first.

Some one must have noticed that nipping of the plates only partly solved the problem of leaf breakage and that in the nipped and tapered spring the shorter leaves showed the same signs of distress as in the nip-less, non-tapered springs. A new step then taken consisted in using thinner sections of material for the shorter leaves; this was a great advance and gave us the well-known "graded spring." Grading the leaves resulted in the more frequent breakage of the master leaf, although the life of the spring was at times increased. If the plates in the graded spring were tapered, master leaf breakage was even more common.

How to Increase the Safe Load

Grading and tapering the leaves may produce, each by itself, an increase in the endurance of a leaf spring, but as applied to the ordinary spring their advantages are frequently lost. The question arises—Can these practices be combined so that their individual advantages are retained and their disadvantages eliminated? How can we increase the safe load on a plate spring and distribute the stresses uniformly among the plates? In short, how can we obtain the greatest amount of work from a given weight of material? By "work" we mean here the product Load $\times$ Deflection/2, also called the resilience.

These are the questions that led to the production of the Landau High Endurance spring. In the succeeding paragraphs the principles on which this spring is built will be explained.

The fact has now been established that, in order to get the greatest amount of work out of any plate in a plate spring, the plate must be tapered. It has also been shown that the finer or longer the taper, the greater is the reaction between plates. Higher reactions mean higher permissible loads (within limits). A spring made in accordance with these suggestions will show increased endurance, but there will also be a greater tendency to intermediate and main-plate breakage. How can we reduce the main-plate breakage and still maintain the increased endurance?

Nip Reduced to a Minimum

In the ordinary spring we introduce a nip to prevent main-plate breakage, but this increases the stress in the shorter plates and reduces the safe load. In the Landau High Endurance spring the nip is reduced to a minimum, or even entirely suppressed. To reduce the probability of breaking the master leaf first, the latter is made thinner than the shorter plates. This construction is opposed to all past practice in spring making, but it is contended that all ordinary plate springs are designed on a false theory.

Beginning at the foundation of the spring, the shortest plate, this is made of the thickest section, as it must support the successive pressures of all the plates above it. We taper this leaf so as to make the stress in it uniform. The reaction between it and the next longer leaf is now increased, and hence the load on the longer leaf may be augmented. To reduce the stress in this leaf in spite of its carrying an increased load, its cross section may be slightly decreased; this will compensate for the long taper of the "leaf below." Finally, several leaves may be made of the same cross section, provided we make them of such lengths that the steps, or overhangs, become progressively shorter as we approach the master leaf. Thus the steps in the Landau High Endurance spring are not equal, as in most ordinary springs. Succeeding plates may now be made thinner still, and the steps reduced in length correspondingly, the master leaf, as a rule, being made the thinnest, thus keeping the bending stress in it lower than in any of the other leaves. Springs thus made will have their life increased and be free of master-leaf breakage.

Surplus Width of Plate Removed

Making an exception of the master leaf, the maximum stress in the various leaves will be about the same, although the stress along the entire leaf length will not be uniform. Fig. 11 shows the stress curve of one of these leaves. It is seen that the stress rises rapidly, reaches a maximum in the step, then sinks quickly to a minimum which occurs opposite the point of support of the leaf below, then rises again slowly and reaches another high value at the fixed point. The metal in the portion indicated by the cross section lines does only a small amount of work.

It may seem that if the taper were carried further along the length of the plate, the cavity in the stress curve could be eliminated, but this is not so; the entire curve would shift to the left, the reactions and the maximum stress would increase, and the upper and longer plates would break first, notwithstanding their being thinner. What, then, can be done to smooth out this stress irregularity without encountering new troubles?

It is well known that the stiffness (or rigidity) of a rectangular cross section, such as a spring leaf, varies directly as the width and as the cube of the thickness. Also, the strength of such a section varies directly as the width and as the square of the thickness.

Therefore, we may increase the stress in the inert portion of the plate by taking out the surplus material from the width, Fig. 12, which for the reason just given will not greatly affect the reactions or the strength. In this manner we may very easily obtain our desired stress rec-

tification. In Fig. 12 are also plotted the section modulus (strength), bending moment and the stress distribution curve of the same plate. It may be mentioned in passing that this figure is taken from a plate of a spring that was designed in 1916 and of which springs there are some 70,000 in use at the present time.

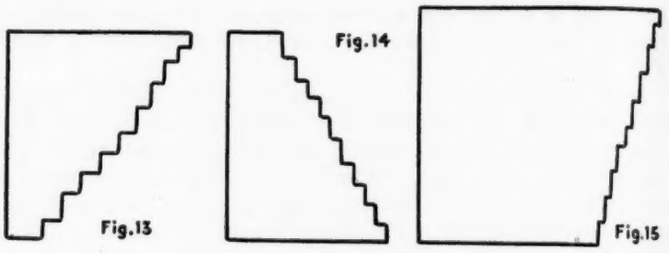
The removal of metal from the width of the plate, in the area covered by the "plate below," results in making the stress in the plate quite uniform. In the ordinary plate without the stress rectifying slots the stress curve has "saw teeth"; eliminating these was the last step in the development of the High Endurance spring.

When plate springs made in accordance with these specifications are subjected to vibratory tests, plates will break in rapid and irregular succession, and—most important of all—there will be an enormous increase in the number of deflections. The master leaf will remain intact until all, or nearly all, the other plates have failed.

Life of Spring Not Related to Static Tests

In the past it was the custom to measure the physical worth of a spring by deflecting it and noting the load and deflection required to give it a permanent set; the spring which took the greatest load and deflection without showing a permanent deformation was considered the best—supposedly the one having the greatest life. With the introduction of the vibratory testing machine it was soon found that the "life" of a spring, that is, the number of deflections it will withstand before a plate breaks, is in no way related to the static tests above mentioned. It was often noticed that of two springs giving the same deflection without showing a permanent set under the static test, one had a much greater life than the other.

In the following three figures we have attempted to illustrate diagrammatically the results of dynamic tests of life of a plate spring. Fig. 13 is a breakage diagram of a plate spring whose leaves are neither tapered, graded nor nipped. This same spring, when tapered in the orthodox manner, will give the breakage diagram shown in Fig. 14. An improvement in the life of the spring takes place with a change of location of the fracture; it is the master plate that succumbs first instead of the short leaf. This could be reduced—or perhaps completely obviated—by nipping the plates. A small gain might thus be had, but not without reducing the life, that is to say, breaking the



short plate (instead of the main leaf) sooner. These diagrams are not the results of tests but are a fair representation of the order in which the plates would break if the tests were continued by replacing the plate that breaks and continuing until the whole series had broken. The practical spring has some nip in the plates, and the homogeneity of the material is a factor which is neglected in the curves, but the results would still be practically the same if these factors could be considered.

Fig. 15 shows the breakage diagram of the different plates in a Landau High Endurance spring. This spring has approximately the same weight as that of Fig. 14. The horizontal length of the lines is a measure of the life of the particular plate.

Landau High Endurance springs are manufactured by the Sheldon Axle & Spring Co.

Air Service Reports Results of Tests on Sand-Cast Duralumin

AN investigation has been carried on by the Engineering Division of the Air Service at McCook Field to determine the effect of chemical composition and of heat treatment on the physical properties of sand-cast duralumin, a copper-magnesium-silicon-aluminum alloy, the more specific object of the investigation being to develop an alloy which upon treatment would show the following mechanical properties:

Ultimate strength (minimum), pounds per square inch	29,000
Elongation in 2 in., per cent	4.5
Brinell	75-95

One sand-cast alloy which, after heat treatment, will have the required physical properties, conforms to the following chemical analysis:

	Per cent
Copper	2.25-2.75
Iron	1.00-1.50
Silicon	.25
Magnesium	.40- .65
Aluminum	Remainder

The heat treatment for this alloy is:

1. Heat for two hours at 925 deg. Fahr.
2. Quench in water at 212 deg. Fahr.
3. Age at 212 deg. Fahr. for two hours.

The alloys with lower copper content do not respond materially to heat treatment. When the copper content exceeds the maximum stated above the ductility drops off rapidly.

The effect of iron is to increase the ductility apparently without modifying the tensile strength.

The effect of varying the silicon content has not been determined, but is being investigated.

The effect of increasing the magnesium is to embrittle the alloy; decreasing it below 0.40 per cent prevents a complete response to heat treatment.

The physical properties can be modified by different heat treatments. An accelerated aging at 212 deg. Fahr. for twenty-four hours increased the tensile strength from 10 to 15 per cent, but there was a decrease in ductility of about 20 per cent.

A BUS chassis powered with a six-cylinder Continental engine of 3¾ in. bore and 5 in. stroke has recently been placed on the market by the Western Truck Manufacturing Co. The chassis is assembled from well known parts.

The gearset is of Fuller manufacture, giving four forward speeds and one reverse. Direct drive is on third and the fourth is overgeared .7 to 1. The clutch is a multiple dry disk type.

A Shuler front axle is employed and the rear axle is a double reduction Wisconsin. Both axles have Timken bearings. Brakes are located on the rear wheels and air brakes or front wheel brakes may be had as special equipment.

Standard tire equipment consists of 36 by 6 in. pneumatics, and disk wheels are employed.

Q. E. D. Steam Motor Bus Uses Winslow Boiler

New product from Chicago has two-cylinder compound engine. Burner automatically controlled. Air delivered by motor-driven blower. Rapid acceleration and low fuel cost per mile claimed.

WITH a view toward obtaining freedom from vibration at all speeds, smooth and rapid acceleration, fuel economy, together with other known advantages of steam, a steam motor bus, called the Q. E. D., has been developed by the Steam Bus Syndicate of Chicago.

As the entire success of a steam-driven motor coach depends on the boiler, the major part of the development work has centered around this unit. The bus uses a Winslow boiler of the water tube type and sectional construction, each unit being a complete boiler. The water stands about half way up the section when cold, but rises upon application of heat. As the heat application is continued, generation of steam takes place more rapidly, causing a rapid flow of water through the lower tubes, which is responsible for the non-scaling feature of the Winslow boiler. Sediment, which precipitates in any steam generator, in this case is swept out of the path of circulation and settles into the mud collector.

Burner control consists of an electric switch operated by a diaphragm communicating with the steam space of the boiler. Rising pressure acting on the diaphragm causes the switch to stop the motor supplying air and fuel, while a heavy spring causes the switch to close when the pressure falls. Air is delivered in a fixed amount by a motor-driven blower, which also drives the fuel pump.

The pilot burner is mounted in the main duct of the on and off burner. Fuel flows to the nozzle of the pilot burner by gravity and there atomized by a jet of steam at a pressure of 5 lb. per square inch. The pilot light is not required for starting when distillates just heavier than kerosene are used, as the fire is ignited by a bit of burning waste and the immediate starting of the blower and fuel pump.

The water level in the boiler is maintained by a thermostatic tube slightly inclined from the horizontal to give a more gradual operation, a method which has been in use for many years in stationary plant practice.

A triplex water feed pump is mounted on the forward end of the engine and runs at ¼ engine speed. The exposed end of the feed pump crankshaft carries an overhung crank disk which drives a Detroit lubricator.

Two-Cylinder Compound Engine Employed

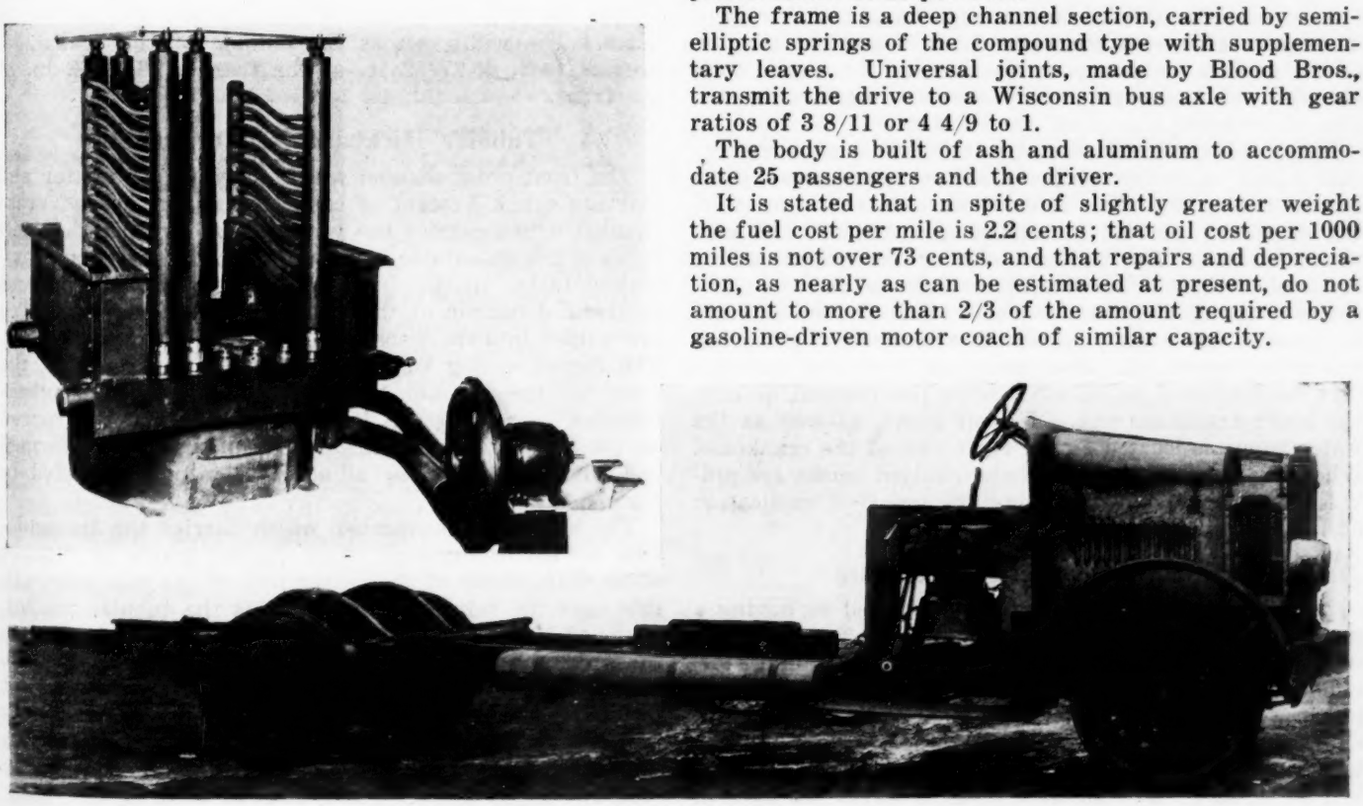
The compound engine, located directly behind the boiler, has two cylinders of 3-in. and 7-in. bore and 5-in. stroke. A convenient pedal button controls a simple device for starting at boiler pressure.

The main engine valves, which are actuated by a Joy valve gear, are of the balanced piston type without rings and made of chilled cast iron ground to size. The steam admission may be changed from 85 per cent of the full piston stroke to 25 per cent.

The frame is a deep channel section, carried by semi-elliptic springs of the compound type with supplementary leaves. Universal joints, made by Blood Bros., transmit the drive to a Wisconsin bus axle with gear ratios of 3 8/11 or 4 4/9 to 1.

The body is built of ash and aluminum to accommodate 25 passengers and the driver.

It is stated that in spite of slightly greater weight the fuel cost per mile is 2.2 cents; that oil cost per 1000 miles is not over 73 cents, and that repairs and depreciation, as nearly as can be estimated at present, do not amount to more than 2/3 of the amount required by a gasoline-driven motor coach of similar capacity.



The chassis of the Q. E. D. steam motor bus, showing location of the various units. The fan is placed in a shroud just behind the radiator-condenser. Insert—The Winslow boiler partly assembled. Each section is a boiler in itself. Air is delivered in fixed amount by motor-driven blower which also drives the fuel pump

Tubular Backbone Frame Reinforcement Used on New Flint

This construction and seven-bearing crankshaft are outstanding features. Units designed to secure maximum accessibility. Characteristic Durant practice shown in four-point suspension of engine, open flywheel and location of gearset amidships.

GENERAL characteristics of the Flint were given in these columns when the car was first announced last January. Numerous features of construction had not been decided upon at that time, however, so that a thorough technical description was not possible.

The accompanying article tells about every engineering feature of the Flint and presents drawings of important parts which will be of special interest to engineers. The complete facts given here have not been available previously for publication.

TUBULAR backbone reinforcement of the frame construction and a seven-bearing, six-cylinder engine are the outstanding features of the Flint car. In addition to the tubular muffler which serves as a torsional reinforcing member in all of the Durant layouts, two parallel tubes of large diameter are welded in between the first and second cross members, forming a sub-frame which carries the engine and extends the torsional reinforcing effect throughout the entire length of the chassis frame.

Characteristic Durant design is shown in the four-point suspension of the engine, open flywheel and the location of the gearset amidships on the back of the center cross channel. This general arrangement is dictated by the idea of securing maximum accessibility.

Every unit is designed and installed in such a manner that it may be readily inspected, serviced or removed without disturbing any other unit. Both generator and starting motor are carried in saddles and retained by quick acting clamps. The timing chain or the clutch can be removed without otherwise disturbing the engine. The clutch coupling, gear box, propeller shaft or rear axle can be removed individually without the necessity of removing any other component. Both main and lower rod bearings may be inspected or adjusted after the removal of only the lower crankcase pan. The oil pump, as well as the water pump, is located on the right side of the crankcase. Wherever possible, inaccessible lubrication points are provided with extensions, bringing the point of application of the Alemite gun within easy reach.

Frame Construction a Feature

In a brief way, this car may be described as having a six-cylinder engine of 3⅜-in. bore and 5-in. stroke. The wheelbase is 120 in. and the tread 56 in. Straight side, non-skid cord tires measuring 32 x 4½ are mounted on either wood or disc wheels as optional equipment. Semi-elliptic springs are used all around, the front being 2 in. wide and 35 in. between eyes, and the rear 2¼ in. wide and 54 in. long. For all body types, 8 leaves are used in the front springs and at the rear 8 leaves again, with the exception of the sedan, in which case an extra leaf is added at the rear. Bronze bushings are pressed in all spring eyes and the spring bolts are hardened and ground to ⅝ in. diameter, being drilled out and tapped for an Alemite connection.

As the installation of the engine, gear box and clutch and brake operating pedal assembly varies somewhat from the conventional, due to frame construction, this feature will be described before the other units are considered. The usual frame, consisting of pressed steel channel side members of 5½ in. depth through the middle portion and 1¾ in. width of flange, and five cross members, is reinforced by three longitudinal tubes which are welded in place. The width across the outside of the frame decreases from 40 27/32 in. at the rear to 26 27/32 in. at the front.

Tubular Backbone Reinforcement

The front cross channel which carries the radiator and starting crank bracket is connected to the second cross channel which carries the gear box by two parallel steel tubes of 2⅜ in. outside diameter which are spaced approximately 18 in. apart. In order to withstand and prevent torsional deflection of the frame, the ends of these tubes are welded into the webs of the respective cross channels. The forged spring bolt brackets at the rear ends of the front springs are not only riveted to the side members but also to the tubes. A lateral extension which is forged on the bracket extends inward, terminating in a formed end which fits over the adjacent tube and is riveted in place.

The second cross member which carries the transmission is tied to the rear cross channel which is situated about 6 in. ahead of the center line of the rear axle. In this case the reinforcing member is the tubular muffler. Stamped steel heads and mounting brackets are welded to the ends of a seamless steel tube of 5 in. outside dia., approximately 3/32 in. wall thickness and a length of about 55¾ in. As illustrated by Fig. 1, the muffler pipe passes through a packing gland at the front head of the muffler and is fastened to the rear head by means of a welded-in plug and a cap screw. Three rows of 5/32 in. dia. holes, 84 in all, are drilled in the 2¼ in. dia. lap jointed muffler pipe to form the gas outlets within the muffler. The final muffler outlet is formed by a lipped opening in the rear

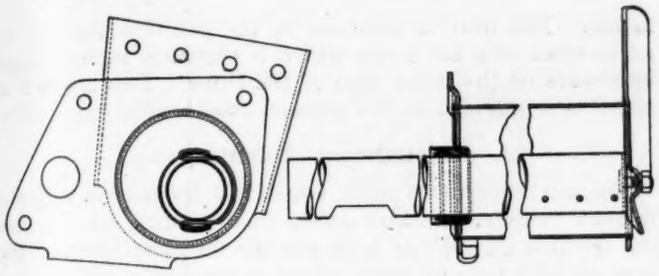


Fig. 1—Muffler and frame reinforcement construction

head. During assembly with the frame, the entire muffler structure is hot riveted in place, there being three ½ in. dia. rivets at the center cross channel and four similar rivets at the rear cross channel.

As the three tubes form an integral part of the frame structure, and extend approximately from the front to the rear axle centerlines, an unusually rigid structure is obtained. It is stated that the springs do all the work of shock absorption with this design and are therefore modified in such a way that very easy riding and unusual road holding characteristics are achieved. The rear spring horns are tied together by a cross member consisting of a steel spacer tube of about 1⅝ in. dia. which is riveted at the ends to each side member and an inserted draw bolt of ¾ in. dia. having a nut outside of each of the side members. As this draw bolt has long bearings in each of the opposite spring bolt bracket forgings, this assembly assists in resisting torsional flexure of the frame. The entire scheme results in the formation of a very stable, rigid platform for the mounting of the body.

A fourth cross channel is located about 18 in. back of the member which carries the gear box. In this case an inverted channel is riveted to the side members through gussets. The brake operating countershaft and foot brake equalizer mechanism are carried in brackets which are bolted underneath this cross channel.

Six Cylinder L-head Engine Used

The engine, which is built by Continental, is of the L-head type with six cylinders of 3⅜ in. dia. and a stroke of 5 in., the displacement being 268.3 cu. in. and the A.L.A.M. rating 27.3 hp. A compression ratio of 4.55 : 1 is used and the firing order is 1-5-3-6-2-4. The torque curve peaks at approximately 170 ft. lb. at 700 r.p.m. and the horsepower curve attains a maximum of approximately 70 hp. at 2500 r.p.m. The torque curve remains very close to the top figure for several hundred revolutions after the peak and then falls gradually.

The crankshaft, which is drop forged from S.A.E. 1045 steel and heat treated in accordance with S.A.E. specification H, is finished all over and balanced both statically and dynamically. Main and lower rod bearings are ground to size and the cheeks of elliptical contour are finished in a forming lathe. All bearings on the crankshaft are 2 in. dia., the lower rod bearings being 1½ in. long. The length of the seven main bearings from front to rear are:

1-Front	2 17/64 in.	5	1⅛
2	1⅛	6	1⅛
3	1⅛	7-Rear	2 15/16
4-Center	1¾		

A driving sprocket for No. 45 Morse silent chain of 1½ in. width and ½ in. pitch is located on the front end of the crankshaft, inside of the timing gear cover. Just in front of this cover a Lancashire vibration dampener is carried on the crankshaft. At the rear end of the shaft an oil slinger is located just ahead of the 4 in. dia. flywheel mounting flange. This flange is 5/16 in. thick and carries six ⅜ in. dia. bolts on a 1 9/16 in. radius. Oil holes are drilled to all the lower rod bearings from the main bearings. End play of the shaft is adjusted by the installation of shims between the timing sprocket and the forward face of the front main bearing. The crankshaft is carried in bearings of the following composition:

	Per cent
Tin	85.0
Copper	7.5
Antimony	7.5

The upper half of the bearing shell is set in a bored seat in the crankcase while the lower half is cast in the bearing cap.

Tappet Carriers Removable Individually

Connecting rods are drop forged steel, the shank being I-section and the length, center to center, 10½ in. The lower babbitt bearing, the composition of which has already been given, is cast in and the bushing which bears on the piston pin is pressed into the upper end. The piston pin of tubular section, ⅞ in. outside dia., is secured in the piston by a lock screw. Three 3/16 in. wide rings are carried in the piston, above the center of the piston pin. A clearance of .003-.0035 in. is allowed in fitting the pistons in the ground cylinder barrels.

As the cylinders and upper half of the crankcase are cast en bloc, the cylinder head is separate, the joint between the two being located approximately flush with the extreme upper position of the piston head. Liberal water space surrounds the cylinder barrel throughout the combustion swept portion, the valve ports and seats and the combustion space. A copper asbestos gasket forms the joint between the cylinder block and head. Standard ⅞-in. thread spark plugs are inserted into the combustion space from the top of the head. A thermostatic valve in the water outlet which is near the front of the head regulates the temperature of the outgoing water to 160-170 deg. Fahr.

The valves which are seated in the upper surface of the cylinder block have a clear diameter of 1⅝ in. and the angle of the seat is 45 deg. Semi-steel heads are

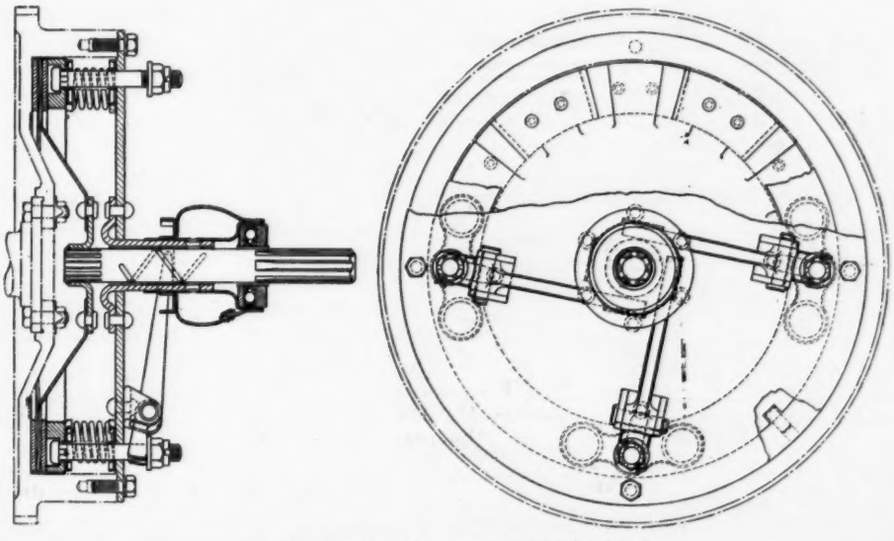


Fig. 2—Sectional views of Flint clutch

welded to carbon steel stems of .3705-.3715 finished dia. by a butt welding process, after which the entire valve is heat treated. The lift of both intake and exhaust valves is 5/16 in. The overall length of the valves is 6 31/64 in. and the stems are piloted in inserted cast iron bushings. Valve springs and tappet adjustment mechanism are inclosed by three large hand hole covers, each being retained by a single bolt.

Mushroom tappets with the usual set screw adjustment are carried in sets of four in cast brackets, each of the

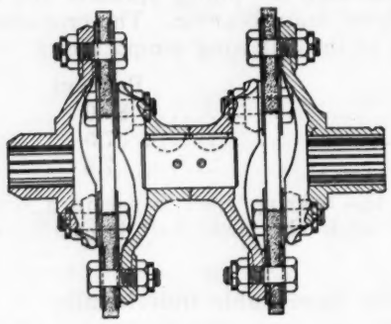


Fig. 3—Fabric coupling between clutch and gear box

three being secured directly above the camshaft by two bolts to bosses cast on the cylinder barrels. Any one of the tappet carriers can be removed individually through the hand holes.

Camshaft Bearings Reamed in Crankcase

The camshaft is drop forged from steel of the S.A.E. 1020 specification and case hardened, all cams and bearings being ground to finished size. Four bearings which support the camshaft are reamed directly in the crankcase. The dimensions of these bearings from front to rear are:

	Length, in.	Dia., in.
Front	1¾	2 5/16
Intermediate	1	2 9/32
Intermediate	1	2 17/64
Rear	1¼	1¾

A triangular silent chain drive which is inclosed in the timing gear case by a pressed steel cover rotates the camshaft and auxiliary shaft from the crankshaft. Morse No. 45, 1½ in. wide, ½ in. pitch chain is specified. The tension of the chain is regulated by rocking the entire water pump base unit around the lower stud of a three bolt flange. The unit is retained in the position desired by adjustment of a set screw which is threaded in the flange and bears on the outer stud of the three. Two inspection plates are provided on the pressed steel timing case cover.

Distributor Mounting

The auxiliary drive shaft which has its bearings in the flanged cylindrical water pump base casting also drives the ignition distributor head and the oil pump through the medium of a pair of small helical gears and a jointed vertical shaft. The distributor head is retained in a telescopic mounting at the top and the oil pump housing is bolted to a flange at the bottom of the water pump base. As these units, in addition to the water pump, rotate with the base when the chain is adjusted, all connections to the crankcase, including intake water line, intake and outlet oil pump line and naturally the ignition cables, are made long and flexible. This feature also applies to the connection between the water pump and electric generator, which consists of a short shaft carried in short lengths of rubber hose which are secured to the shaft ends by circular pressed steel clips and through bolts.

An extension which provides for outside drainage of any leakage carries the water pump at the rear of the base. The impeller of the centrifugal pump is mounted on the same shaft as the drive sprocket. Bronze packing nuts are fitted into each side of the pump housing and a compression grease cup is mounted in an accessible position. A moderate length of rubber hose connects the pump outlet to the elbow connection which is bolted on the water jacket between the centerlines of cylinders 4 and 5.

Saddle mountings and band steel clamps retain both the generator and starting motor near the rear end of the block, the former being in approximate alignment with the water pump shaft and the latter, located just above the plane of the crankshaft at the extreme rear. The saddles for both are cast integrally with the cylinder block and fly-cut to size. The two steel strap members of each clamp are hinged on pins carried in the frames of the saddles and are formed at their outer ends so that the action of the clamping bolt is amplified in pressing the barrels of the electric units against their seats. DeJon electrical equipment is standard on the engine.

As the oil pump is located outside of the crankcase, the ⅜ in. dia. suction line is retained, as it passes through the wall, by a three bolt flange which is located imme-

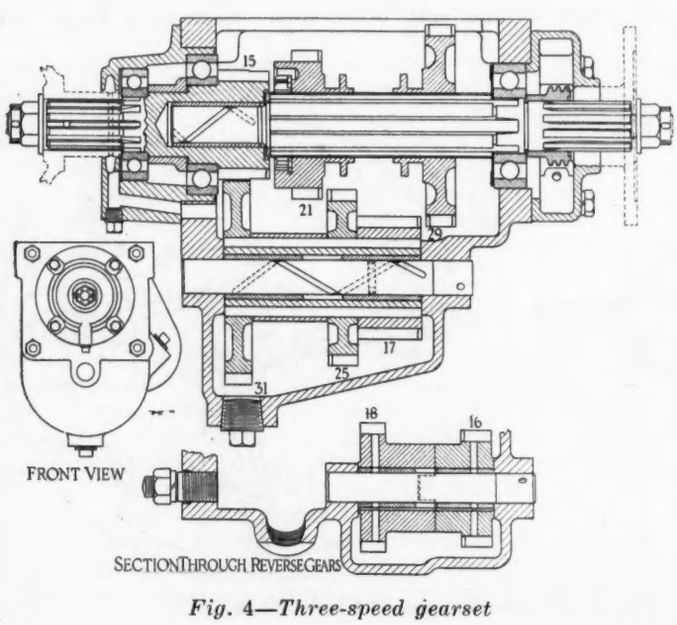


Fig. 4—Three-speed gearset

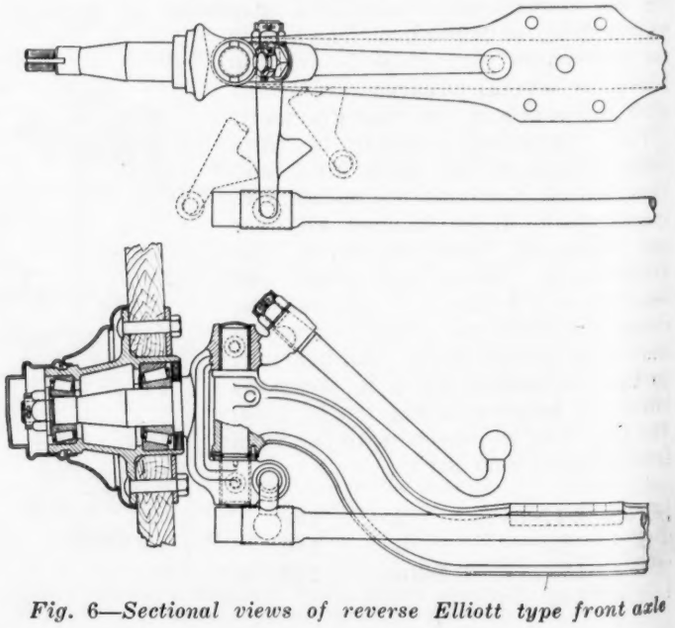


Fig. 6—Sectional views of reverse Elliott type front axle

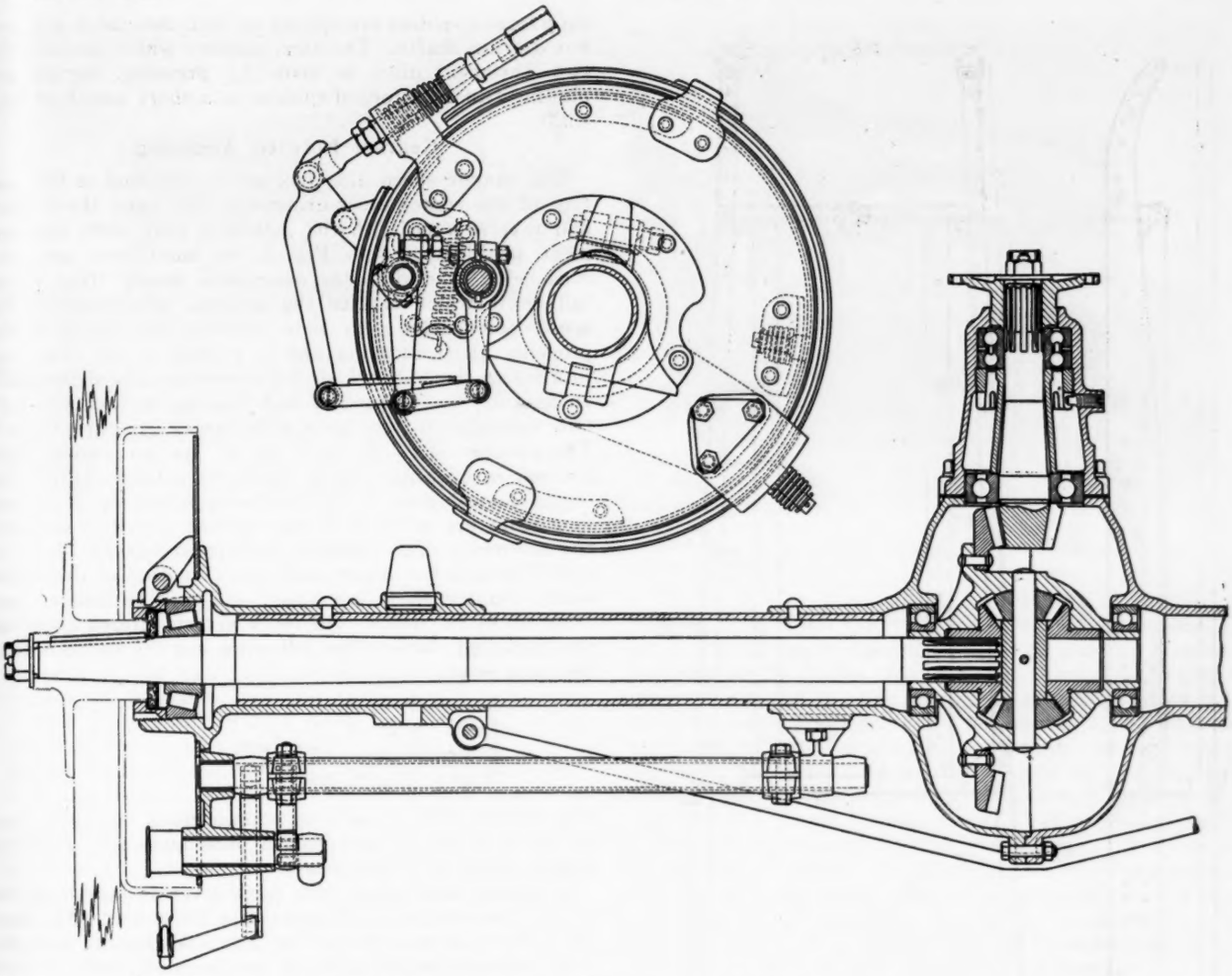


Fig. 5—Sectional view of built-up, semi-floating rear axle

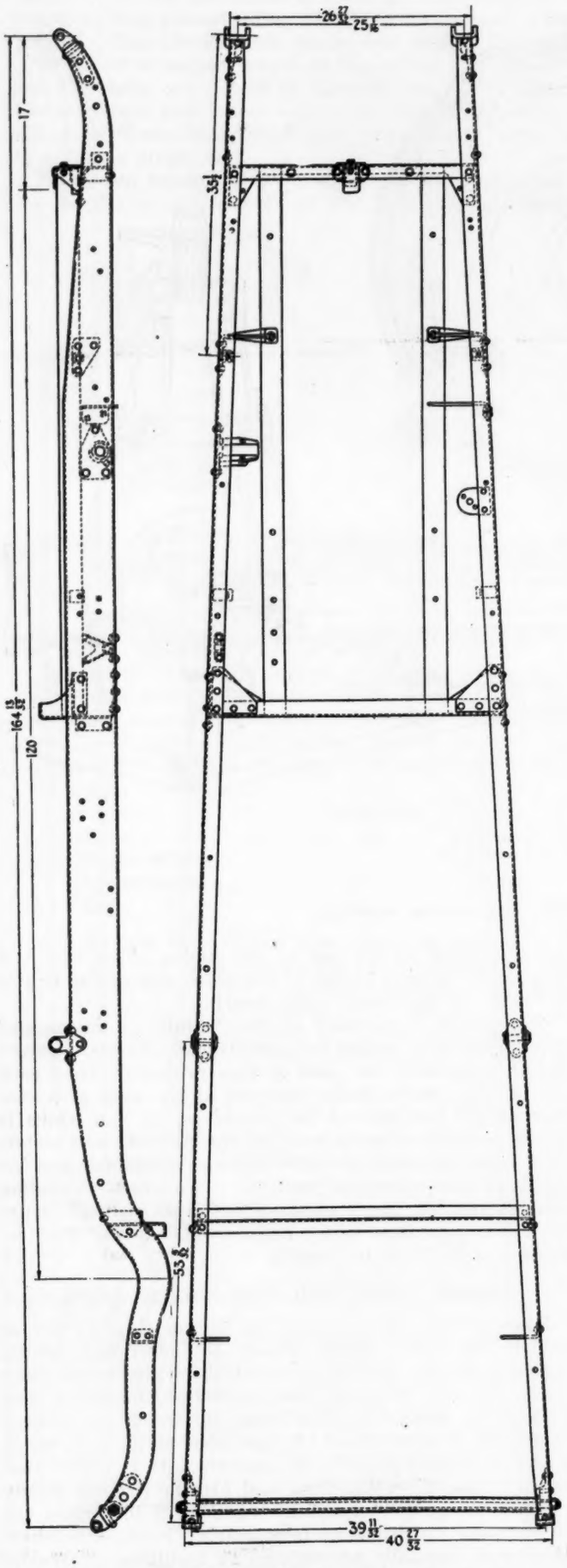
diately above the bottom flange just back of the centerline of cylinder No. 4. The tube then extends downward inside of the crankcase to the bottom of the lower pan. A tube of the same diameter connects the outlet side of the pump with a tapped hole which is located at the base of the same cylinder. This tapped hole, in turn, connects with a longitudinal steel tube in the crankcase. Seven tubes connect the longitudinal tube with each of the main bearings, as the crankshaft is drilled, the lower rod bearings are also oiled under pressure. At the front end, a pressure regulating valve of the ball and adjustable spring type is connected by an overflow pipe to the water pump base housing. The various bearings and gears in this housing are lubricated by the overflow which is finally returned to the crankcase. Splash pockets are located over each camshaft bearing. The valve operating mechanism and the cylinder walls are oiled by the spray from the lower rod ends.

A combined intake and exhaust manifold of the usual Continental design is located on the left side of the cylinder block, a hot spot being placed over the vertical intake pipe which carries a 1¼-in. Stromberg Model OX-2 carbureter. The exhaust outlet is placed at the front end of the manifold and the exhaust pipe passes under the steering gear housing. A 16 in. dia. 4-blade fan is carried in a slotted bracket which provides for an adjustment of 2 in. of the ⅝ in. wide rubber belt which is driven from the vibration dampener. The fan is driven at 2.1 times crankshaft speed. A combined breather tube and filler cap is located on the top of the timing chain case. A bayonet oil gage is placed on the right side of the engine alongside of the center main bearing.

The engine is mounted at four points on the parallel tubes which are welded into the frame. Formed spacers and through bolts are used at lugs projecting from each side of the timing chain case and at the ends of a cast yoke at the rear end of the crankcase. A pan which is bolted to the rear yoke protects the flywheel and clutch. Dust plates are secured between the side channels and the edges of the crankcase flanges. Two studs extending through the top flange of the front cross channel secure the Fedders radiator which has a frontal area of 20⅝ in. width and 21 13/16 in. length.

Durant Clutch with Four Springs Added

Four springs are added to the Durant clutch which is used in the Flint. These springs, the additional making twelve in all, are located concentrically with the releasing bolts. The two 10 in. dia. molded friction rings have been replaced by molded friction segments which are riveted alternately to each side of the light steel clutch disc, which is bowed slightly under each segment. It is stated that unusual ease of engagement and greater driving ability are secured by this modification. Fig. 2 illustrates the construction which has no pilot bearing in the crankshaft flange and unusually adequate oiling facilities. Thermoid disc construction, as illustrated by Fig. 3, is used for the coupling between the clutch and gear box. The usual



Frame assembly showing forward pair of reinforcing tubes in place

drop forged spiders are splined on both the clutch and gear box driving shafts. The steel member which connects the two Thermoid discs is made by pressing, keying and pinning two drop forged spiders on a short length of solid shaft.

Gearset Located Amidship

The change speed gear box which is bolted to the rear face of the center cross channel is the usual three speed and reverse type with the standard gear shift arrangement, as illustrated by Fig. 4, the hand lever and gate rods being carried in the detachable cover. The splined tail shaft which carries the shifting gears carries the speedometer drive gear in a housing just ahead of the propeller shaft coupling and is piloted at the front end in a bronze bushing which is pressed into the drive shaft. In addition to the annular ball bearing on the tail shaft, two bearings of the same type center the drive shaft. The counter shaft is built up of splined sleeves with pressed in bushings which rotate on a fixed shaft. The constant mesh gear at the front end, a spacing sleeve and two gears are pressed on the splined sleeve to complete the assembly. The constant mesh gear has an 11/16 in. wide face and the others, with the exception of the double width counter shaft low speed and reverse pinion, have faces of ¾ in. width. All teeth are chamfered round on the engaging sides. The following are the reductions in the gear box:

Reverse: 3.75 : 1
Low: 3.52 : 1
Intermediate: 1.74 : 1
High: Direct drive.

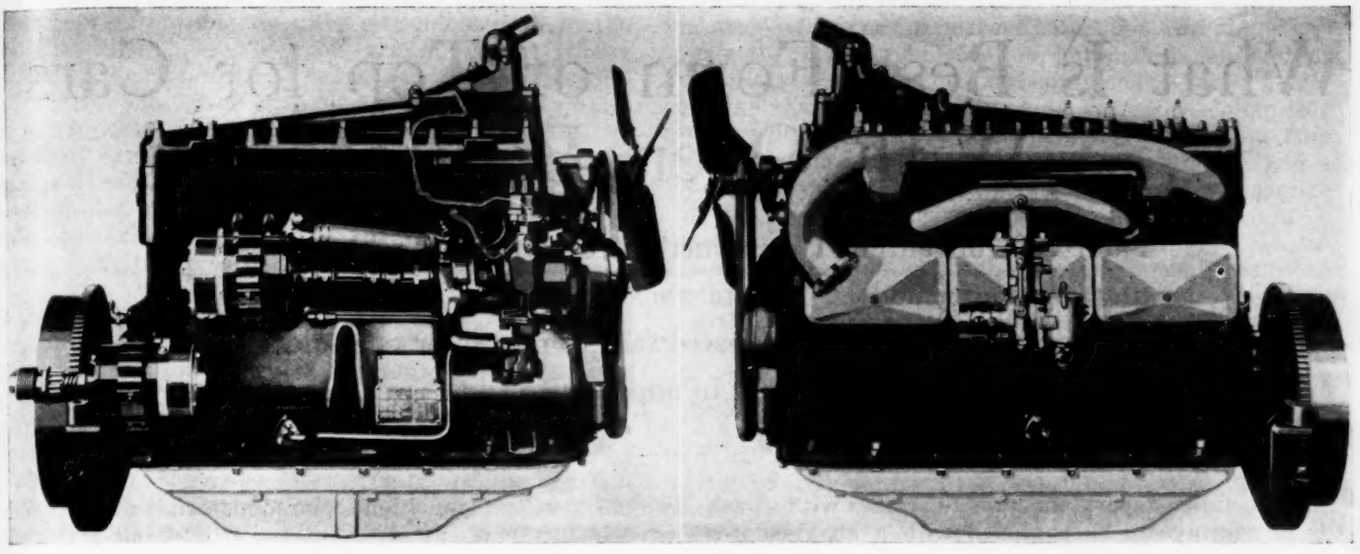
The reverse idler is built up of two gears which are connected by a tongue and groove joint and carry bushings which rotate on a fixed shaft.

A rather short gear shift hand lever is located at the center, close to the heel board of the front seat. The hand brake lever is mounted on the left side channel with the grip inclined inward so that it is concealed under the cowl in the released position. Clutch and brake pedals and the clutch throw out shaft are carried in saddle brackets on the two tubes which form the engine support.

Inner and Outer Brakes Band Type

Spicer universal joints and a tubular propeller shaft transmit the drive from the tail shaft of the gear box to the rear axle, which is illustrated by Fig. 5. The semi-floating rear axle is of built-up construction, consisting of two cast center members, two tubular steel members with cast brake anchors which carry the wheel bearings and a truss rod. The drive pinion is mounted in a single and a double row annular ball bearing with a screw retainer back of the latter, while the ring gear and differential are carried on single row bearings of the same type. Helical bevel gears are used, the standard reduction being 4.77 : 1, although two other combinations are optional. The bevel differential equalizing gear has four pinions which are centered on a two-piece spider.

Rear wheels, either wood or disc, are secured at the hub on a tapered extension of the live axle shafts. This taper extends inward and accommodates a taper roller bearing which is secured in the brake anchor casting by a sleeve nut and clamp. The inner ends of the live axle shafts butt against the equalizing pinion spider. As illustrated in Fig. 5, both inner and outer brakes are band type. The brake drum is 14. in. dia. at the outside and the bands, lined with Raybestos, are 2 in. wide. The brake operating shafts and tubes are long and are supported at the inner ends by brackets which are mounted on the cast center members. The outer contracting bands are connected to



(Left) Right side of engine showing distributor, water pump and generator mounting. (Right) Left side of engine showing hot spot manifold

the brake pedal through a bar type of equalizer which is located on the cross channel just back of the gear box. The inner brakes which are connected to the brake hand lever are not equalized. The rear springs are underslung and as a Hotchkiss drive is used, are anchored at the front and have pressed steel shackles at the rear.

Reverse Elliott construction is used at the front axle which is I-section. The absence of troublesome drop forging operations is illustrated by Fig. 6, as every forged member may be finished to form at the hammer with no further bending or twisting operations. This construction also works out very well for export purposes where right hand drive is desired. The knuckle pin is secured in the axle end and bronze bushings which are pressed in the knuckle form the bearing. Downward thrust is taken at the lower face of the boss at the axle end by a pinned bronze washer and a free steel washer.

Front wheel centerlines are inclined inward at an angle of 2 deg., the wheels being carried on taper roller bearings. Ball joints are used at the ends of all the steering arms. The cross link and the drag link which connects to the Warner steering gear are both of one-piece tubular construction. The cross tube is straight while the drag link has a slight offset for spring clearance.

Fuel Tank at Rear End of Frame

The gasoline tank is carried at the rear end of the frame by a ¼ in. dia. cold rolled steel rod and a malleable cast bracket which is hung from a steel bracket riveted to the side member at each end of the tank. The center of the tank is supported by a steel strap that is riveted to a clamp bracket which is mounted on the rear cross tube. The tank is made of No. 20 gage terne plate with overlapped, beaded and soldered joints. Gasoline is supplied to the engine from the tank by a vacuum tank which is located on the forward face of the dash. A K-S gasoline gage which operates on a hydrostatic principle is located on the instrument board. This gage was described in the July 5 issue of AUTOMOTIVE INDUSTRIES.

Electrical equipment includes drum type headlights, cowl lights and tail lamp. The instrument board which is set well under the cowl is illuminated by a light fastened to the inside of the cowl at the top. The starter switch is mounted on the right side channel just ahead of the dash and is operated by a cross shaft and link from the starter pedal on the floor board.

Three body styles are now being fitted to this chassis and a two-passenger roadster will be in production soon. As equipped ready for the road, the phaeton weighs approximately 3100 lb., the four-passenger coupe, 3280 lb., and the sedan, 3450 lb. The phaeton is fitted with a permanent top and the usual side curtains. All bodies are secured to the chassis by ten bolts, eight passing directly through the side channels and two through brackets attached to the frame. Pressed steel fenders, dust shields at the foot boards and a splash guard at the radiator are similar on all models. Scuff plates are standard equipment on all foot boards. The tire carrier which was described in the Engineering Number of AUTOMOTIVE INDUSTRIES is carried by forged brackets from the rear ends of the side channels and the rear cross tube.

Process for Extracting Shale Oil

DR. HERMANN WOLF, a leading German scientist, has invented a process of extracting oil from shale which is suggestive of great possibilities. This new method of refining is known as the Mutol process, and a refinery is to be installed at Chester where the material treated will increase the present maximum 30 per cent of oil to a ton of shale to a minimum of 65 per cent, it is claimed. This will result in the cost of gasoline obtained by this method being reduced by more than 50 per cent.

The inventor claims that his process, which is being kept a dead secret, is merely a "speeding up" of Nature's method in creating petroleum deposits. "The new process," he said, "will reduce a crude oil, upon which Nature would have to exert the full force of her pressure and heat for ages in order to change it to a lighter oil, to such lighter grade almost in an instant.

"Where my process differs from the processes now in operation, and particularly the "cracking" process, is that it dispenses with the application of high temperature and that highly expensive refining agent, hydrogen. It raises the percentage of pure benzine extracted from crude oil from the ordinary rate to one of double the quantity.

"It is of special interest to countries where shale oil deposits occur. Shale oil had often been untreatable on account of the presence of sulphur. By a new process, which also is a continuous one, this element, which injures the refining apparatus, may be largely eliminated, and shale oil converted into a high percentage of pure benzine."

What Is Best Form of Top for Cars With Open Bodies?

Faults of conventional construction, especially the khaki type used on sport models, lead to consideration of other materials and structures. Pyroxylin-coated fabrics may offer one solution. Permanent top has advantage in appearance and is weather-tight.

IF the so-called "sport" model is to remain with us and is to continue to be equipped with a khaki-colored top, it is clear that some radical improvements in the material employed will have to be made, especially in the case of cars in the lower price classes, since it is generally agreed that the appearance of the present top leaves much to be desired after a few months of service. An unsightly top, of course, adds another element of difficulty to the used car problem and contributes, with other factors of a somewhat similar nature, to a more rapid depreciation in the value of sport cars as compared to that of cars of normal standard construction.

A prime factor in the situation is the fact that all khaki-colored materials fade, some much less than others, but all to a greater or less extent. Dye manufacturers have given the matter long and extensive study and have spent many thousand dollars in research calculated to produce a non-fading dye, but are free to admit that the problem still appears a long way from solution. Some claim that the only way to make even a fairly satisfactory uncoated top material of khaki color is to dye the yarn before it is woven into the fabric. This method is followed in some rather expensive grades, especially some of the imported fabrics. Unfortunately this process greatly increases the cost of the goods. While it is claimed to result in the best uncoated materials of khaki color, the material is not entirely free from fading. In time it becomes soiled, so that its appearance after considerable service does not compare favorably with that of the better grade of coated fabrics generally employed on standard models.

Some of the heaviest and most durable khaki-colored fabrics depend upon a very close, hard weave to give them their waterproof properties, but the less expensive grades are usually double texture, the two plies of fabric being cemented together with a rubber cement which is depended upon to make them waterproof.

CURTAINS are made from similar material. Since they are seldom up as much as the top, they are apt to fade less, and there is often a considerable difference in color between curtains and top after a few months of service. The difference is apt to be much accentuated in case a new set of curtains is applied. Then, too, there is often a marked difference in shade between different batches of khaki top material, even though the manufacturer makes great efforts to maintain uniformity, and this leads to certain complications both in top manufacture and in service.

Under these circumstances it is small wonder that both top material manufacturers and car and body builders are turning their attention to other possibilities in the way of novelty tops. Light colored materials are favored greatly for sport car tops, but since the basic material employed in rubber-coated fabrics is dark, such coatings are necessarily of dark color, usually black. There is, however, another class of coated materials which is worthy of consideration, namely, pyroxylin-coated fabrics, which are available in practically any desired color, light or dark. Many of these exactly duplicate in appearance the finest leathers, while others are made to resemble fabrics or have some artificial design.

THESE pyroxylin fabrics have already been used extensively on permanent tops of the California type, as well as in interior trimming of both open and closed bodies, and are, when well made, exceptionally durable and at the same time handsome in appearance. Their chief fault is a tendency to deteriorate in time if subjected to repeated folding or to the mechanical abrasion which takes place when any folding top is carried for long periods in a folded position, but even rubber-coated fabrics are subject, in time, to similar deterioration.

It must not be forgotten, furthermore, that great advances in pyroxylin coatings have been made in recent years, so that difficulties which were formerly common are now much less pronounced and less frequent. In addition, it is well to remember that the tops on a great majority of open cars are seldom if ever folded, consequently troubles due to folding, which were at one time more or less common, are now comparatively rare.

Because of these facts and the very common faults to which khaki tops are subject, as outlined above, some manufacturers of coated fabrics believe that tops made with pyroxylin coatings will give far less trouble, especially if well-made goods are employed. Such damage as may occur in the few cases where tops are frequently folded will, it is contended, be far less serious than the troubles now encountered with most khaki tops.

Damage which sometimes results from repeated folding or normal abrasion with folded tops when pyroxylin-coated fabrics are employed does not necessarily affect external appearance, even though it may impair the waterproof qualities of the material. To prevent this, one large manufacturer of both pyroxylin and rubber-coated goods is now planning to put out a new line of sport top material. This will be composed of two plies of fabric, the outer one coated with pyroxylin in a large variety of colors and finishes and the inner an uncoated whipcord of such a character as to require no headlining. The two will be fastened together with rubber cement, which will still maintain a waterproof top, even though the outer coating is injured by repeated folding or chaffing. This product is expected to find considerable

favor as a substitute for uncoated khaki colored fabrics.

Now that collapsible tops are so seldom used in the closed position, there is good ground for inquiring whether permanent tops will not largely replace the folding variety. The latter have an advantage from a shipping standpoint, in some cases, at least, and are demanded by certain buyers who prefer to ride without a cover overhead. On the other hand, the permanent top can often be made to look better when new and to remain better looking for a longer period. A better weather-tight inclosure is also more easily attained.

IN general there has been a tendency to build a more elaborate and more expensive structure when the permanent top is employed, but there would appear to be no real need for so doing in cases where low first cost is a prime consideration. In fact, there is reason to believe that a permanent top frame and covering can be made slightly cheaper, as well as better looking, than a collapsible top so long as a similar type of construction is employed. If such a plan is followed the argument that a permanent top and open body cost as much as a closed body loses its force.

Of course, if framed panels with glass lights are included with the permanent top, the cost may approximate closely the closed job, but such panels are not a necessity, at least as original equipment. Better fitting curtains than are often found on cars with collapsible tops are possible with a permanent top and without any increased expense. If the user chooses later to add a set of framed panels with glass lights for winter service this can be done easily and cheaply if the car manufacturer makes them up in reasonable quantity. Such individual fitting as might be necessary could be done easily at any trim shop and at small expense, providing a reasonable flexible design is employed. This would lower the initial investment as compared to a closed car, but give most of the advantages of the closed job after a moderate secondary investment.

Some plan of this character may prove to be the salvation of the "open" car business. It is, in any case, worthy of consideration. Whether better plans are ultimately evolved or not it is plain that car manufacturers must take steps to improve the open car, at least until manufacturing facilities can be adjusted to meet the closed car demand.

New Aircraft Engine Undergoing French Government Tests

THE first non-poppet valve engine for aviation use is at present undergoing official tests before the engineers of the French Government Aeronautical Technical Department with a view to being accepted as a subsidized type. Built under Mortier-Wattel patents, the engine is a twelve-cylinder V-type of 120 by 180 mm. bore and stroke rated at 400 hp.

The outstanding claim for this engine is exceptional accessibility of the valves, any one of which can be taken out and replaced in a few minutes without lifting the cylinders or disturbing any other part. A piston type distributor is made use of to admit the charge, hold compression and exhaust the gases. It is raised by a cam and closed by a coil spring. The distributor comprises two pistons in the same vertical plane, united by a tube, the upper piston, which carries three rings, covering the intake and exhaust ports, and the lower one, which acts as a guide, receiving a ball bearing roller in contact with the cam. The coil spring is on the head of the upper piston and in contact with the detachable head of the distributor gear.

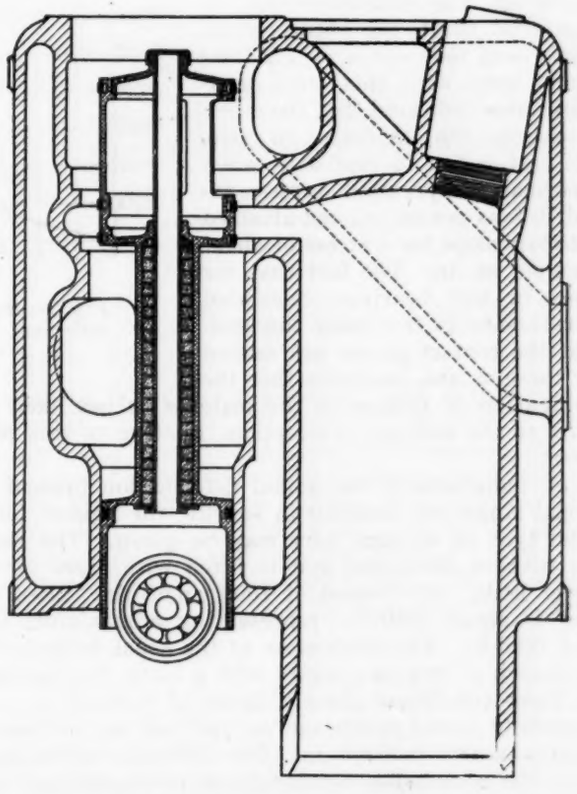
Unusual Valve Operation

During compression and explosion the valve is stationary. It is raised by the cam to uncover the exhaust port and moved down by the coil spring to uncover the inlet, which is above the exhaust. As the tube uniting the two pistons is subjected to the heat of the exhaust gases, it is encased by an outer tube with asbestos packing between the two. Lubrication is assured through the tube uniting the two pistons, and as a vacuum is created above the upper piston on its downward stroke, oil is drawn up from the basechamber to the piston and the guide.

The return of the distributor being spring controlled, the only effect of a seizure would be for the piston to remain stuck in its guide. By removing a bayonet attached cap the spring can be removed and the distributor drawn out.

Before being built for aviation purposes the engine was applied to an automobile and with a piston displacement of 160 in. developed 52 hp. at the peak of 2600 r.p.m.

[Referring to the sectional drawing, a liner, not shown, evidently goes into the valve chamber.—Editor.]



Section through cylinder casting and piston valve of Mortier-Wattel aircraft engine

New Theory Would Rate Ball Bearings on Endurance Limit

Carrying capacity standard developed which takes into account the desired life of product. Experimental work shows length of service affected by load and speed, and by temperature rise in operation. Application of fatigue tests difficult.

By A. W. Macaulay*

SINCE the earliest research on the subject, it has been appreciated that the balls and races operate in service under loads at the contact points representing stresses well beyond the elastic limit of the material. Stribeck's data as to temporary and permanent deformation were the starting point, and, having found that permanent set resulted from the application of quite small loads, he was immediately faced with the problem of determining the safe values for the specific load per ball. His fundamental formula for the load-carrying capacity of the single-row design was:

$$W = (KND^2)/5 \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (1)$$

where W = rated capacity of the bearing in lb.
K = specific load per ball.
N = number of balls.
D = ball diameter in one-eighth-inch units,

and contained a specific load K capable of variation and development to suit different conditions.

Regarding the characteristics of the material itself, the coefficient of elasticity was taken at $c = 1/2{,}120{,}000$, and tests with this steel hardened in water indicated that the curve representing the increase in permanent set began to rise only when the normal compression stress exceeded 70 tons per sq. in., and attained a maximum slope for a stress of about 85 tons per sq. in. The fact that the stresses in ball bearings calculated with reference to the mean compression at the contact points are seldom under these values, indicates that the determination of fatigue in the material is not likely to conform to the ordinary conceptions relating to this phenomenon.

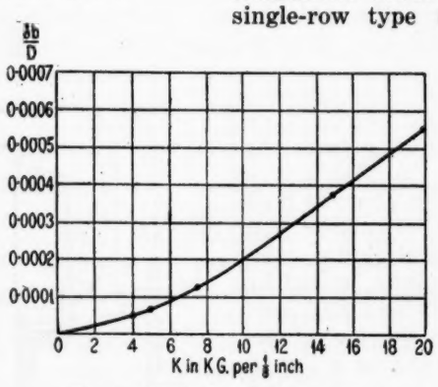


Fig. 1—Relation between specific load and permanent set of bearing balls

As an indication of the actual deformation present in a normal single-row bearing in service, the figures for a medium type of 45 mm. bore may be given. The bearing is without filling-slot and is fitted with eight ⅝ in. diameter balls. At a speed of 1000 r.p.m. the "rated capacity" is about 1600 lb., representing a maximum ball load of 1000 lb. The application of the usual formula for the approach of two race tracks with a ⅝ in. ball between under these conditions gives a figure of 0.00192 in., and the resulting actual permanent set per ball surface would be approximately 0.00003 in. The difficulty of fixing a limit to the permissible temporary or permanent set will be appreciated from a consideration of these small figures.

Stribeck endeavored to fix capacities first of all by studying the relation between the permanent set and the ball diameter. In Fig. 1 is shown the relation between the specific load expressed in kg. per ⅛ in. ball diameter in relation to $\delta b/d$, which represents the permanent set divided by the ball diameter. For $K = 10$ kg. the curve has attained its maximum slope, and Stribeck concluded therefrom that 10 was the safe limiting value for the specific load for this design of bearing. Tests with bearings under different loading at varying speeds appeared to substantiate this, and design was primarily based on these findings. For a double-row self-aligning bearing (30 by 72 by 19 mm.) fitted with twenty-six ⅜ in. diameter balls, running at a speed of 1000 r.p.m., the value for the specific load K represented in published "rated capacities" is by coincidence about the same as given by Stribeck for the single-row type (22 lb./(⅛ in.)²), in which the race radius was two-thirds ball diameter. The corresponding figure for the single-row bearing of the same dimensions would be, say, 41 lb./(⅛ in.)². The "rated capacities" of the two bearings at 1000 r.p.m. are 1025 lb. and 803 lb. respectively, the single-row bearing being without filling-slot and fitted with eight 7/16 in. diameter balls. It will be observed that, while the double-row bearing has the relatively smaller specific load value, the permissible capacity is actually 20 per cent greater. The capacity of the filling-slot type lies theoretically between these, but its reliability as a double-purpose unit is liable to be upset by the lack of continuity in the raceways.

It might be thought that in determining the life of ball bearings at the present time, a fresh start could be made to replace the somewhat arbitrary "rated capacities" by a more accurate function, but this is not possible by reason of the impossibility of applying the stress theories. The "rated capacities," therefore, remain the basis of working, and from them are to be developed fresh expressions for the resulting life.

Practically all the tests developed in the ball-bearing factory have referred to the control of the product in the course of manufacture, and little attempt has been made to standardize a commercial test with reference to the performance of the completed bearing.

In estimating the fatigue limit in materials, the method developed by Wöhler was based on the rotation of a spindle at about 1400 r.p.m., and the fatigue limit in bending de-

* Abbreviated from a paper presented to the Institution of Automobile Engineers, London.

termined by the ability of the specimen to stand up under the load for a period represented by 3 to 10 million revolutions. The number of revolutions before fracture for varying loads when plotted gave a curve which, if extended, indicated the position of the actual fatigue limit corresponding to an infinite number of revolutions, but the longest test actually applied was probably that represented by 100 million revolutions of the spindle. It was appreciated that if test work of this kind was to have commercial value it must be shortened, and recent research on bending and torsional fatigue tests has enabled this to be done with considerable success. It may be added that the fatigue limit determined for a wide range of material does not in any instance approach the stresses already referred to as operating in the ball bearing. Further, a consideration of the case will reveal the difficulties attending any attempt to apply standard fatigue tests to a ball bearing.

Fatigue Limit Expressed as Specific Load Per Ball

It has been found necessary, therefore, to express the fatigue limit in terms other than stress or deformation, and the unit selected is the specific load per ball with reference to the carrying capacity of the complete bearing. In conjunction with the specific load, the prime factor determining the life is the number of stresses under which any point in the race track is operating up to the point of failure.

The question here arises as to which element in the ball bearing suffers the most severe punishment. The number of stresses present is phenomenal in comparison with that covered by fatigue tests in ordinary strength of materials. A ball bearing, for example, may indicate the beginning of fatigue phenomenon after fully 300 million revolutions, and if such a bearing were fitted with 12 balls per row (being of the self-aligning type), a point on the stationary outer race would be exposed to no less than 3000 million stresses. As another example, it may be mentioned that in an ordinary application of a similar design operating at 1000 r.p.m. for 4 years at 8 hours per day through 300 days in the year, a point on the stationary outer race has to stand up to 6700 million stresses.

Practical experience shows that, in bearings of which races and balls are of the same material and standard manufacture throughout, when the highest-grade balls are used, failure almost invariably occurs first of all in the race track. This applies to single-row and double-row self-aligning journal bearings as well as to the orthodox two-point contact thrust bearings. The ball by virtue of its shape is more amenable to accurate finish and superior in its capacity to resist strain. In addition, the balls in any design of ball bearing do not maintain the perfect rolling path, and the same points on the ball surface are consequently not being continually stressed. This relief is not present in the case of the race tracks, where each point on the surface has to meet the severe conditions continuously.

Inner Race the Weaker Element

The results are somewhat altered according to which race is rotating. Dealing with the races only, the weaker element in the single-row bearing is the inner race, whether the inner or the outer race is rotating. The nature of the failures under test substantiates this. In the case of the self-aligning bearing, the weaker race of the two is usually found to be the stationary one.

It might be thought also that under pure thrust load or combined radial and thrust load, the increased fatigue would come entirely on the balls, a point on the race track being subjected to no greater number of stresses in a given time than under radial duty. As a matter of fact, the imposition of axial load introduces bursting stresses on the races, not readily amenable to calculation, but which, nevertheless, have a very considerable effect on the life of the bearing.

These considerations reveal the diverging views which might be held regarding the selection of the element in determining fatigue, but it is considered satisfactory to select always the stationary race for the self-aligning bearing, and the inner race for the single-row type.

It has already been stated that the fundamental values for the specific load K were developed by the ball-bearing supplier in the course of his work, and these take into account in a primary manner the variation in ball diameter and speed. It is found necessary, however, to introduce another factor to connect the specific load with the number of stresses in the determination of the life, and this factor might be styled the "ideal specific load" K_i.

In other words, the specific load K determined first of all an arbitrary capacity for the bearing from considerations of material, deformation, etc., while K_i modifies this figure when a certain determined life is to be obtained.

Turning now to the experimental work, this applied primarily to double-row self-aligning ball bearings, the tests being about 300 in number and the bearings varying between light types of 15 mm. bore to heavy types up to 175 mm. bore, while the speed range was from 300 to 3000 r.p.m.

The inner ring was the rotating element for all the journal-bearing tests, which combined all types of load from pure radial to pure thrust.

Experimental Work with Stresses

The data relating to the self-aligning type are given in greater completeness, as the corresponding figures for the single-row journal bearings and thrust bearings were not of so exhaustive a nature.

If a is the number of stresses to which a point on the outer race is subjected during one revolution of the inner race,

r_y = the radius to the point of contact between ball and outer ring
r_i = the radius to the point of contact between ball and inner ring
N = the number of balls in the complete bearing.

Then

$$a = \frac{N}{1 + \frac{r_y}{r_i}} \text{ for the stationary outer race} \quad (2)$$

$$a = \frac{N}{1 + \frac{r_i}{r_y}} \text{ for the stationary inner race} \quad (3)$$

the stress reaching its maximum twice as each ball passes the point. The stress under consideration is not the simple compression stress at the center of the contact surface, but the severe flexure stress at the edges of the pressure area. If the shaft has made n millions of revolutions, then the number of stresses to which the point on the outer ring has been subjected will be $a.n$ millions.

The connections between the various factors represented by these fatigue tests may be expressed in the following formulæ:

$$a.n = \left(\frac{154}{K_i - 4.4}\right)^3 - 5 \quad (4)$$

(Millions of stresses)

while conversely the "ideal specific load" is:

$$K_i = \frac{154}{\sqrt[3]{a.n + 5}} + 4.4 \text{ lb./(⅛ in.)}^2 \quad (5)$$

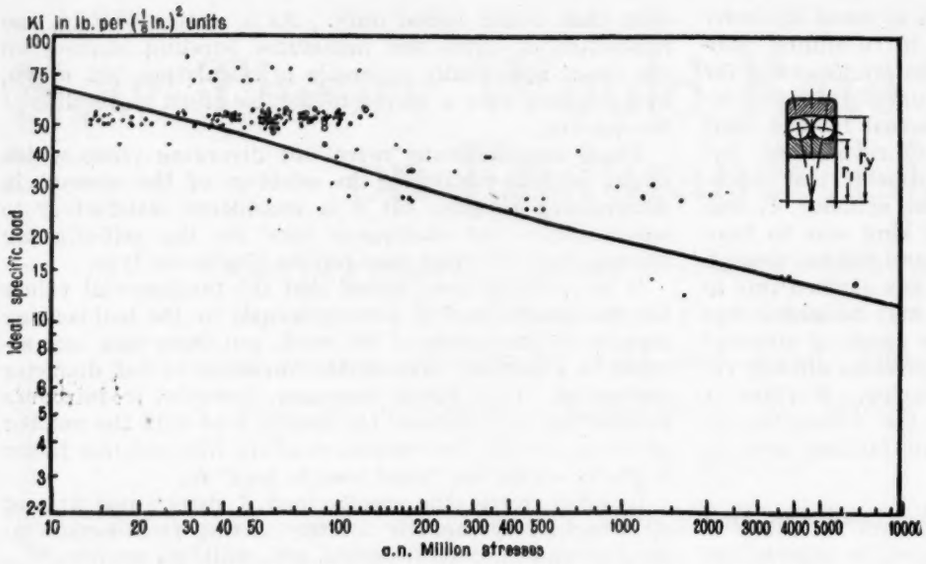


Fig. 2—Relation between ideal specific load and life of bearings

This implies that for $K_i = 4.4$ lb./(⅛ in.)² the life of the bearing is infinite, thereby indicating the fatigue limit. It is impossible to determine this limit accurately as the curve within the entire range covering these tests is a declining one. The greatest number of stresses covered by the tests is 6700 million, already referred to.

The relation between the specific load and the "ideal specific load" is:—

$$K_i = K(1 + 0.0001v) \quad (1 + 0.007D^2) \text{ lb./(⅛ in.)}^2 \ldots (6)$$

where v = the number of r.p.m., and D = the ball diameter in one-eighth-inch units.

In arriving at K_i, it was found that to plot K against the number of stresses brought many values outside the curves altogether, showing the necessity of making additional provision for the two variables, ball diameter and speed. The relation between K and K_i, as given in formula (5), was arrived at by the usual trial method.

In Fig. 2 is illustrated the experimental value for the number of stresses in millions obtained during the tests on spherical ball bearings. A line drawn through these has been so fixed that only 13.6 per cent come beneath it, and it will be recognized that a conservative attitude has been adopted. The extent of this conservatism is readily judged.

It will be appreciated that the bearings in many cases will give considerably longer life than is indicated by the formulæ, but it is necessary to cover not only the slight inequalities in manufacture which are constantly the subject of scrutiny, but also to cover the irregularities in loading present in many applications, these irregularities not always being amenable to calculation.

Higher Load Permitted at Low Speeds

Considering the most common case of a rotating inner ring, the application of formulæ (2) and (4) gives approximately a life of 1000 hours continuous running with the radial load as given in the rated capacity steadily applied. The corresponding life for an overload of 100 per cent is approximately 100 hours, and for a case where the load is half the value given as the rated capacity the resultant life is about 10,000 hours.

The proportionate life for full load and half load suggests a cubic law, the resulting life varying inversely as the cube of the load variation, but this law does not hold with rigor where the running is intermittent.

A consideration of formula (3) shows that the number of stresses operating on the inner race, where the outer race is rotating as in the front hub, is considerably greater, and the life correspondingly reduced. This reduction is approximately 30 per cent, which indicates that in order to obtain the same basic life of about 1000 hours a factor of 1.125 over the rated capacity should be adopted. The other relations as to proportionality follow on as before.

It is seen that for the general case a factor of about 2.5 indicates a life of, say, 24,000 hours, corresponding to 10 years operation under usual factory conditions of 8 hours per day for 300 days per annum. As a matter of fact, the bearing will probably not be under full load all the time, and there is little doubt that the factor of 2 will be sufficient to give the ten years' service. The following figures provide the comparison between the loads at different speeds obtained in this way, and the loads according to the formula for the life.

R.P.M.	10	25	50	100	250	550	1,000	2,500	5,000
According to table with safety factor=2	880	847	803	741	660	594	517	407	286
According to life formula	1,760	1,364	1,122	924	726	594	495	363	264

This reveals the fact that a decidedly higher load can be permitted at low speeds, while in the higher speed range the two values are in fair agreement.

The same principle applies to the self-alining radial bearing when subjected to combined radial and thrust load. The relation between the load to be used in formula (1), the actual radial load present, and the thrust load present, is:—

$$W = R + \frac{1}{2 \sin \gamma} \cdot A \ldots\ldots\ldots\ldots (7)$$

where W = load as given in formula (1).
R = existing radial load.
A = existing thrust load.
γ = the pressure angle.

In Fig. 3, which is a summary of tests for combined radial and thrust load for spherical ball bearings, it will be seen that formula (7) gives sufficient accuracy.

The use of the formulæ here, however, should involve greater care owing to the difficulty in determining the actual thrust load in many applications.

The corresponding data for single-row journal ball bearings would appear to be covered in the following manner:—

$$a = \frac{N_1}{1 + \frac{r_i}{r_y}} \text{ (Ref. Fig. 4) for stationary outer race.. (8)}$$

$$a = \frac{2N_1}{1 + \frac{r_y}{r_i}} \text{ for stationary inner race ..... (9)}$$

where N_1 = the number of balls.

For single-row bearings without filling-slot

$$a.n = \left(\frac{264}{K_i - 8.8}\right)^3 - 5 \ldots\ldots\ldots\ldots (10)$$

$$K_i = \left(\frac{264}{\sqrt[3]{a.n + 5}}\right) + 8.8 \text{ lb./(⅛ in.)}^2 \ldots\ldots (11)$$

$$K_i = K(1 + 0.0001v) \quad (1 + 0.007D^2) \ldots\ldots\ldots (12)$$

For single-row bearings with filling-slot

$$a.n. = \left(\frac{198}{K_i - 6.6}\right)^3 - 5 \quad \ldots\ldots\ldots\ldots\ldots\ldots \quad (13)$$

$$K_i = \frac{198}{\sqrt[3]{a.n + 5}} + 6.6 \text{ lb./(⅛ in.)}^2 \quad \ldots\ldots\ldots\ldots \quad (14)$$

$$K_i = K(1 + 0.0001v)\ (1 + 0.007D^2) \quad \ldots\ldots\ldots \quad (15)$$

A single-row bearing without filling-slot, dimensions 45 by 85 by 19 mm., is fitted with ten 7/16 in. diameter balls. If it be subjected to a radial load of 528 lb. at a speed of 243 revs. per minute with the outer race stationary, the value of K as obtained from formula (1) is 21.5 lb./(⅛ in.)^2. From this K is found to be 23.9 lb./(⅛ in.)^2 and $a.n$ 5295 million stresses. The number of stresses per revolution of the rotating shaft is 5·88, indicating a total number of revolutions before failure of 900 millions. The estimated life in hours is consequently fully 60,000. In other words, it may be regarded as infinite, and this result is to be expected when it is considered that the normal capacity of the bearing in question at the speed is practically three times the duty present. The life of the bearing figured on a basis of its "rated capacity" of 1400 lb. at the same speed is 1250 hours.

It has been customary to convert thrust load on a journal bearing of the single-row construction to equivalent radial load by using a factor of 3 or 4, indicating that the thrust capacity is roughly 30 per cent of the figure listed for radial duty. It has long been known that the bearing can take a much greater axial load than is represented by these relations, particularly in those applications where the fatigue is not high.

In America the case of the Fordson tractor worm-shaft is probably unique, the entire radial and thrust load being carried successfully in many instances on single-row non-filling-slot radial bearings. The life in such an application, as figured by the preceding formulæ, would be very short, but the designer has relied upon the actual intermittent running conditions of the tractor in fixing his bearing selection. The same applies to several other American applications of a similar nature, and the principle has been extended recently to several passenger cars of high quality. Three examples which have recently been studied have followed this course of development. The bearings at the pinion and crownwheel included thrust washers, but after test with single-row bearings without filling-slot the thrust washers have been eliminated. These experiments were of an exhaustive nature. In all cases the prime consideration was not the economy in the bearing selection, but the simplification of the mounting and a more accurate and silent drive. The results show that these objectives have been reached.

Another field of application where the same bearing design has given almost phenomenal success is that of the propeller shaft on the aeroplane, the thrust loads varying between 25 and 80 per cent of the listed radial capacity. After endurance tests varying between 200 and 500 hours continuous running, this bearing selection was standardized and gave entire success.

It is suggested, therefore, that the arbitrary method of estimating the thrust capacity as at present existing be replaced by a more flexible system in which allowance is made for varying conditions. It will be appreciated that the thrust capacity is a function of the speed, this being deduced from the other principle that the specific load certainly varies with the revolutions per minute of the rotating race. The specific load also varies with the pressure-angle, which in turn determines the capacity of the bearing to deal with the axial load.

If W = rated capacity of the bearing in lb.
R = the radial duty present in the application.
A = the thrust load present in the application.
v = the revs. per minute.

then for single-row bearings without filling-slot

$$W = R + (0.0004v + 0.8)A \quad \ldots\ldots\ldots\ldots\ldots\ldots \quad (16)$$

and for single-row bearings with filling-slot

$$W = R + (0.0004v + 1.4)A \quad \ldots\ldots\ldots\ldots\ldots\ldots \quad (17)$$

It is only when a speed of 6000 revs. per minute is reached that the factor within the brackets attains its present arbitrary figure of 3 in formula (16).

Endurance for Automobile Application

Taking, for example, a bearing having dimensions 45 by 100 by 25 mm., fitted with eight ⅝ in. diameter balls, the endurance for a probable automobile application may be worked out. The radial duty is 492 lb. and the thrust load 105 lb. at 240 revs. per minute, and by applying formula (16) these loads are found to be equivalent to the radial load of 586 lb., from which the endurance may be figured in the usual manner. It gives an actual life of fully 130,000 hours, which is to be regarded as infinite.

The life of the same bearing under its "rated capacity" of 1800 lb. at the same speed is 855 hours.

It will be seen that in calculating the endurance in the case of a bearing with a rotating outer race the number of stresses is doubled; the life is consequently halved. So far as the automobile chassis is concerned, this fact is of importance in the consideration of the front-hub bearings.

The research regarding thrust bearings is not complete, and it is not proposed, therefore, to put forward formulæ at the present time.

It remains to fix a ready test to which ball bearings of standardized design may be subjected as a check on production. Such a test must be such that it is carried out within reasonable time without sacrificing accuracy, and be based on a simple means of estimating the loads to be applied. This eliminates, for example, the practice of interrupting the test to examine the ball surfaces microscopically for hair cracks.

The law connecting the life of the bearing with the

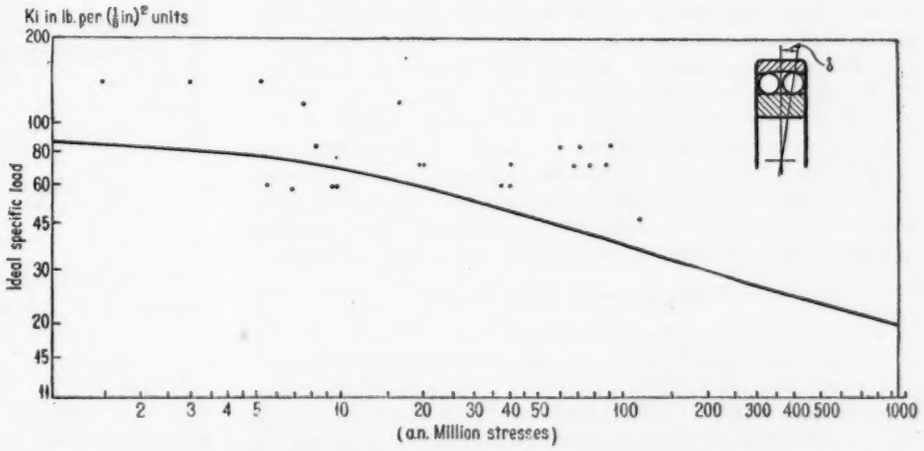


Fig. 3—Relation between ideal specific load (radial and thrust) and life of bearings

number of stresses is approximately a cubic one, but not so with sufficient accuracy to enable it to be applied with rigor. It has been stated that under service conditions a total life of 24,000 hours spread over ten years may be expected from a bearing loaded to half "rated capacity" for the average speed range, and the corresponding life where the bearing deals with the load as given in the "rated capacity" without any factor is 800 to 1000 hours.

In order to reduce the test time to a reasonable length it is necessary to impose overload conditions. A considera-

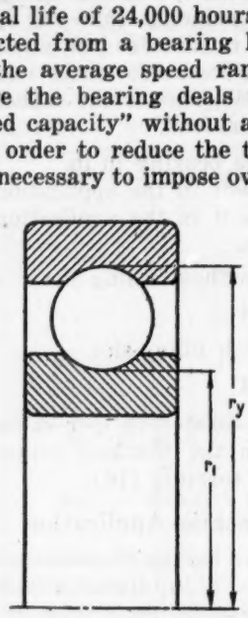


Fig. 4—Diagram of single row bearing

tion of the research data indicates that in general the average size bearings at average speeds will give a life of about 100 hours with an overload of 100 per cent. The slight variations in the internal design of the bearings taken in conjunction with what may be regarded as the remaining "abnormal" running conditions constitute an endurance tolerance on either side of this figure of 100, and the actual value, of course, is readily determined in each case.

Even although the calculation shows the life under 100 per cent overload to be somewhat less than 100 hours' continuous running, the conservatism adopted in the attitude is such that the full running time will usually be achieved. Without wishing it to be understood, therefore, that 100 hours' continuous running is a definite test time for all bearings of the single-row and double-row self-alining construction, it may be regarded as an approximate figure, and normal production should achieve at least 80 per cent efficiency in the test room.

In carrying out a test the bearing is run under observation both as regards temperature and noise. The beginning of flaking in the raceways is soon detected and the running stopped for inspection.

The temperature rise resulting from bearing operation should be fairly constant, and a knowledge of the approximate ruling temperature in an application provides a valuable check on performance.

Assuming the housing design and mounting conditions to be satisfactory, an abnormal temperature rise with a spindle at reasonable speed is an indication either of overload or defective lubrication. A fault in the lubrication system may be due to an excess of grease in the housing. On the other hand, a high temperature in a high-speed application (say about 2000 revs. per minute) may be clear evidence that the limit of safe speed has been exceeded.

Temperature Rise Tests

In order to prove the relation between temperature rise and the load, speed and bearing dimensions involved, a series of tests was carried out with bearings of the radial and thrust types. The radial bearings were principally of the double-row self-alining construction, varying between 12 mm. bore of light type up to 80 mm. bore extra heavy series, the speeds varying between 500 and 20,000 revs. per minute. In the case of the thrust bearings the speed was limited to 3000 revs. per minute.

The research deals mainly with this type of bearing, and the following expression for the temperature rise was obtained:—

$$T = 0.355N \sin \gamma \ (0.454K + 0.305s + 0.0000294 \sin^2 \gamma s^4) \quad (18)$$

where T = increase of temperature in degrees C,
N = number of balls in the bearing,
γ = pressure-angle,
K = specific load lb. per $(\frac{1}{8}$ in.$)^2$,
s = circumferential velocity of the ball in relation to the cage in ft. per sec.

Thus

$$s = (\pi/720) d_2 \ (v - v_r) \text{ ft. per sec.}$$

where v = speed of the inner ring, revs. per minute.
v_r = speed of cage = $(v/2)\ (d_2/M)$ revs. per min.
d_2 = bottom diameter of the groove of the inner ring, in.
M = pitch diameter of the ball set, in.

The formula is only applicable for a minimum temperature rise of 10 deg. C., and under that figure there is no occasion to be concerned with the probable value.

The specific load K to be inserted in formula (18) for pure radial load will be as in formula (1), but in the case of a combined radial and thrust load:—

$$K = \frac{5\left(R + \frac{1}{4 \sin \gamma} A\right)}{ND^2} \quad \ldots\ldots\ldots\ldots\ldots\ldots \quad (19)$$

where R = existing radial load,
A = existing thrust load.

Lubricant an Important Consideration

Values obtained from such a formula assume correct mounting and lubrication. The selection of the wrong lubricant may be responsible for considerable temperature rise, and this question calls for closest scrutiny, especially for the highest speeds. Here oil should be applied in small quantity if success is to be achieved.

In Fig. 5 are given the curves for a few bearings of the medium type of self-alining construction. These curves show clearly the effect of increasing bearing size on the ruling temperature.

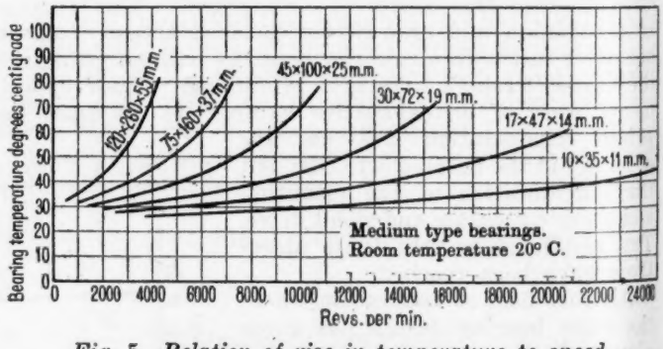


Fig. 5—Relation of rise in temperature to speed of ball bearings

As an indication of the temperature at which a ball bearing may be expected to run normally, provided the mounting conditions and housing design are sound, it may be stated that for a double-row bearing 30 by 72 by 19 mm. running at 5000 revs. per minute, with 286 lb. radial load, which is half its "listed capacity," the temperature rise would be about 13 deg. C. By increasing the revolutions a final speed of 15,000 revs. per min. may be attained before a temperature rise of 50 deg. C. is reached. At the in-

creased speed, of course, the load is beyond the permissible value and the life of the bearing in consequence would probably not be as long as desired.

As for the maximum permissible temperature at which a ball bearing should run, this varies somewhat with the lubrication system. Ball-bearing grease is liable to separate and lose its lubricating qualities at a temperature of about 50 deg. C., and for applications where grease is advisable as a protection against corrosion, this temperature would indicate the limit. The melting point of the lubricant is actually somewhat higher, but that is not the determining factor in running.

A somewhat higher temperature may be permitted with oil lubrication, but with increasing spindle speed the high rubbing velocity between ball and cage sets up a destructive smearing action. The surface of the ball is destroyed and flaking eventually develops. It is difficult to give a safe limit, but a ruling temperature of 70 deg. C. is suggested as the probable maximum for continuous running.

The question of high temperature conditions from external sources is another matter altogether. The safe limit for such operation is about 200 deg. C. The capacity and resulting life under these conditions are both considerably reduced.

In the case of the single-row ball bearing, the experiments have not been as extensive, but so far as they have gone they indicate what is to be expected—that the temperature rise is slightly greater than in the case of the double-row construction for the same load and speed. This follows from the difference in race curvature, and the friction loss is roughly 18 per cent higher. In order to work to the same temperature rise, therefore, the load to be imposed on the single-row bearing would be about the same percentage less than for the double-row ball bearing. This is consistent with the "rated capacities" of the two types.

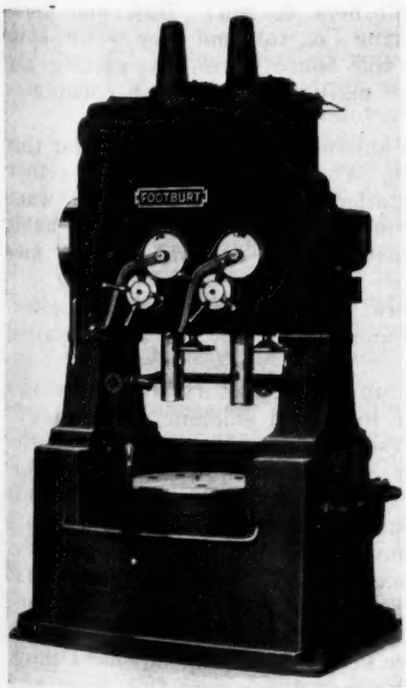
In this case the limiting factor with temperature is the centrifugal force effect, which sets up a high rubbing speed between ball and cage in addition to the heat developed from the spinning of the ball on the race track.

As a matter of fact these limitations apply particularly to the heavy type bearings. The safe speeds and capacities of standardized thrust bearings of the lighter types are sufficiently wide to cover all normal applications.

New Drilling Machine Adapted to Wide Range of Production

INDIVIDUAL control of feed and speed for each of the two spindles and a rotating, indexing work table adapt the new high duty drilling machine of the Foote-Burt Company to a broad range of quantity production. A heavy, rigid construction and a large capacity coolant system fit the machine for drilling, reaming and spot facing operations on miscellaneous parts, including among others, connecting rods, links, hubs, gears and rollers.

Two box section columns support the head, including spindles and driving mechanism, from a heavy base which carries the indexing table and contains the coolant tank of two-barrel capacity. Four bolts of 2-in. diameter serve as tension members in tieing the entire structure together. Columns of different heights are used to establish the best working arrangement of work table, head and spindle extension for the drilling of any particular piece.



Foote-Burt high duty drilling machine

A single pulley, equipped with a lever operated friction clutch and located at the left side of the head, provides the drive for the entire machine. From the pulley shaft motion is transmitted through two sets of forged steel bevel gears to two vertical auxiliary shafts, one of which serves each of the two spindles of the machine. As the mechanism is in duplicate a description of one set will suffice. From the auxiliary shaft take-off gears transmit the drive to a pair of steel helical gears, the second of which drives the spindle. The spindle speed is varied by changing the ratio of the take-off gears. Standard gears in sets are provided for a range of 43-304 r.p.m., and a maximum of 500 r.p.m. may be obtained by the use of a special ratio.

Adjustments of the rate of feed are made by changing the ratio of a pair of take-off gears which transmit the drive from the spindle to the feed mechanism. A range of feeds from 0.006-.168 in. per revolution permits the selection of a rate of feed which is most suited to the operation schedule.

The feed take-off gears transmit the drive through a vertical shaft to the worm of a worm and gear combination at the lower end. The horizontal shaft which carries the worm gear terminates in a capstan wheel at the outer end and also carries a helical pinion which meshes with helical rack teeth that are cut in one side of the spindle sleeve. Similar teeth of the opposite helix angle are cut in the opposite side of the spindle sleeve and mesh with a second pinion, which is mounted on an auxiliary shaft and driven by a pair of gears from the worm gear shaft.

In addition to the power feed, two methods of hand operation for each spindle are provided. After disengaging the positive power feed clutch the spindle may be fed slowly by the hand wheel at the bottom of the head. For quick return or rapid feed any of the levers forming the capstan wheel may be pulled outwardly and rotated, controlling the spindle sleeve by direct rotation of the horizontal feed shaft.

The rotating table is indexed by the operation of the hand lever which is located on the front of the base. This table may be equipped in various ways to accommodate one or more pieces or successive operations on the same piece and is indexed accordingly.

While this machine has been designed for continuous operation or a long run on a single piece, it is not a specialized machine but may be used for diverse manufacture. It is adaptable to many operations which are suited for a two-spindle drilling machine.

Efficiency Is Gained by Minding Details

Test of Good Management Lies in Attention Given Minor Plans and Systems

At a gathering of department heads the president of the Planet Company tackles the problem of reducing expenditures. He tells the men to watch the small things for then there will be no big ones to cause worry.

By Harry Tipper

THE president's office was evidently the stage setting for a conference. The Planet Motor Car Company did not subscribe to the committee system of organization, but conferences were called whenever the occasion required. Mostly the heads of the different departments got together at lunch three or four times a week, so that formal conferences were cut to the minimum. Every week, however, President Billings had a meeting with Jim Chance, the sales manager, John Carter, the production manager and vice-president, the chief engineer, the treasurer, purchasing agent who was also secretary, and the advertising manager.

The men had just assembled for one of these meetings and the president was opening the conference.

"I want to bring up the general subject of increased efficiency at this time" he began, "not in the spirit of criticism but in order to meet what seems to me the inevitable business conditions we face.

"It looks as though the percentage of the sales secured by any price class of cars is pretty stable. I mean it doesn't change year from year a great deal. Raw materials are up, not as much as they were, but still they are somewhat high; wages show no tendency to come down and it is not likely that there will be an immediate drop in the cost of marketing. In fact I have a budget here drawn from the estimates presented by the various departments and these indicate increased expenditures, which, of course, we hope to balance by larger sales.

"However, I don't see how we can figure on larger sales next year—if we are reasonably conservative. We have had the biggest buying year in the automobile business and we have had our biggest year. We should work for a bigger year but we shouldn't base our expenses on it. Now we can't increase the price of the cars without increasing the difficulty of sale because we get into another price class consideration. We can do the jobs if we can increase our efficiency on the way round.

"FOR instance, Jim, you and Jones have figured that we ought to spend $50,000 more in advertising next year. Of course Jones investigated the matter, as that's his specialty, but you agreed. Now do you think that additional amount is necessary? Can't you figure some way of making the advertising more effective so that we can do more with the same money?"

Jones, who was advertising manager of the company, was on the defensive. He had spent a lot of time figuring the matter out with the sales manager and the advertising agent. He had induced them to cut the total from what they had arranged, so he felt as though he had been very careful on the matter.

"I don't see how we can", he said. "On the sales figures we use as a basis, we are spending no more per car than we have always spent. We have more dealers and their proportion is bigger. Advertising competition is keener and we have to make more of a showing to get anywhere. These estimates are cut now from the original amount."

"I don't think you get what I mean, Henry," returned the president. "John, you read AUTOMOTIVE INDUSTRIES very carefully, what do you think of the advertising?"

"Yes, I read it pretty thoroughly, advertising and all. I like the kind of advertising that gives me a lot of information. Those advertisements are the most valuable where the manufacturers are trying to give you what you want and I get a lot of ideas from them—also they frequently get some business."

"THAT'S what I'm thinking about, Henry. Have we been interested in the dealer when we were advertising to him? The people that write the copy, booklets and house organ stuff for our dealers, do they go round and talk with them and get into their problems? For instance, have we talked with them about the used car business, or how to make the service pay and all that sort of thing? Do we keep telling them the details of the car?

"How much money are we spending on stuff which goes to people we can't hope to sell? Ball, you know Jesse Ball, of the Bearing Co., told me they would save $20,000 this year on the house organ by getting the right kind of up-to-date mailing service with constantly corrected names.

"I don't want you to answer fully now, Henry, for this is a general conference. You and Jim will get together later on the more detailed consideration, but I want you to be thinking about it and not get into the habit of doing something just because we did it that way before."

"Well, maybe you're right, chief," Henry replied. "I'll look myself over and get all set for that detailed discussion."

"How do you stack up in the factory, John? Do you think you can get any increased efficiency out there?"

"I think so. Of course, we're working on that all the time. I'll have to buy some new equipment this year. Some of our precision tools are too far gone to suit me and I need to replace grinders. Also I want a fair sized installation of conveyors at different points. However, now that we're mainly on a piece work basis, that is, guaranteed union rate with time study and bonus, our men are mostly earning a good deal more than the regular rate and we are keeping the cost down. I think I can reduce that part about 5 per cent this year, and I am not worrying about wage rates nearly as much as I did. If the turnover keeps on reducing at the present

rate I can do better, not because of the saving in employment service, but because men who know each other and work together for a good while get a better rhythm and pace in their work."

"That's fine, John. I expected that of you. As the old Scotch minister used to say, 'Ye hae the root o' the matter in ye' and I knew once you get all your developments working I could quit worrying very seriously about your jobs."

"Mr. Treasurer, what's your dope on this situation? How does our general organization stack up and are we getting too expensive?"

"Well, of course, our fixed charges are too high. We shouldn't have spent as much as we did on this office building. We could have made it attractive without going so far. Then I think we should consider seriously if we need those expensive quarters we have in New York City, Chicago and Cleveland. They represent a lot of money and, I must confess, I have never been thoroughly sold on the necessity for such salesrooms. Of course, I'm not a sales specialist like Jim here. I do know that our sales rooms should be attractive, but I wish Jim would look into the question of these quarters in the hope that we can do with something not quite so heavy.

"FURTHER, I am inclined to think that we might cut down on our general organization expense somewhat. I do not mean in salaries of individuals. In fact, it might pay us to consider an increased ratio, provided that we can get a more efficient type of worker. I am impressed with the fact that we have a lot of systems at work and I am looking into the matter with the idea that we may have carried some of these beyond the point of actual efficiency for our requirements.

"Well, it looks as though we were getting somewhere with this conference. If you fellows are thinking about it, I know that you will do everything that can be done and when you do that we'll show considerable progress. You know, I'm reminded right now about the way my mother worked out the problem and it is the only way the jobs of efficiency can be successfully tackled. Maybe I've told some of you this story, but it's worth while anyway because it applies.

"MY father died when I was quite a youngster and there was a large family with only a little money. The job my mother had to do was to bring up all the youngsters with a good education, sound ideas, to get good meals and good home atmosphere—out of what there was. Some job, and done a lot better than any of us do our jobs, believe me!

"She did the whole thing. First of all the children worked, the younger ones at home, the older ones in business, and they worked hard because she kept them liking it. Yes! liking it. She could do that.

"I asked her once how she did it. It was done by taking care of all the small matters. Not a thing was wasted, so that there might be plenty. No disgruntlement was allowed to accumulate, no discouragement allowed to grow. Every little matter was so understood that there never were any big ones.

"I guess it's like that with our business. The advertising plan is no better than what the advertisement says to John Carter or one hundred other John Carters; the office system is no better than the intelligence of the clerk; the factory is no more efficient than the worker.

"There are no big plans to improve but there are a lot of small ones and that's where the intelligent management comes in."

What Does It Cost You to Sell?

William R. Bassett, President
Miller, Franklin, Bassett & Co., Inc.

DO you think of your business as a whole, or do you study each phase of it? Do you at the year's end, compare your total sales with the total selling expense and strike an average which you say is your cost to sell for the business as a whole?

This year's percentage compared with last year's may show you that the cost of selling is going up or down. It is, however, a figure of merely historical interest. It comes too late to be of any value; and because it tells not "why" but merely "how much" it is of questionable value anyway.

Because the total selling cost was 5 per cent or 10 per cent or 30 per cent, it does not follow that that was the cost of selling to any particular customer, or in any territory. And yet the total profit is made up of the many small profits from each customer. It is only by subdividing to the necessary degree that cost figures are of value. Lump figures cannot tell "why," and you must know why a condition is wrong in order to correct it.

The first step is to set up a simple card memorandum account with each customer. On the credit side are entered the gross profit on all sales made to him. He is debited with the cost of selling at a predetermined cost per salesman's call. He is also debited with any advertising material furnished to him free, and any special inducements necessary to get his business.

After a few months such records will show surprising things. You may find that your pet customers are not profitable. They may require too many calls, too much in the way of advertising or concessions, or they may buy only the narrow margin lines. Whatever the cause, such a record shows it definitely, and knowing the cause you are started toward finding a cure.

By gathering the figures on the customers' cards in various ways you can find the cost of selling and the percentage of profit by territories or salesmen—even by lines of product in many cases.

I know one concern that stopped selling nationally and cultivated its home markets more thoroughly after finding in this way that the far fields cost too much to sell.

AUTOMOTIVE INDUSTRIES
The AUTOMOBILE
Reg. U. S. Pat. Off.

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Railroad Business at New Peak

MANUFACTURE of automobiles undoubtedly has slowed up in the last three weeks and it is reported that steel production is falling off, but the railroad car-loading record for all time was broken the week of June 30 when 1,021,770 were loaded with freight of all kinds. This exceeded by 3231 cars the high mark established the week of Oct. 14, 1920, and it was the fourth consecutive week in which loadings topped the 1,000,000 mark.

It is significant that merchandise and miscellaneous freight, which includes manufactured products, totaled 593,422, an increase of 31,877 over the corresponding week of 1922.

This record seems fairly conclusive proof that there had been no very serious falling off in general business up to July 1, notwithstanding the "psychology of fear" with which Wall Street had been infected for some time.

If it took 1,021,770 cars to move the freight offered the railroads the week preceding the beginning of midsummer, how many will it take to handle traffic at the peak in October, when the bulk of grain and coal movements are under way? Unless there is a vastly greater slump in general business than now seems possible, the carriers will have ample opportunity to demonstrate their increased efficiency.

Why Prices Are Important

MORE effort will be required per unit of sales this summer than last. This will be due in part to the fact that there is no such increase in the volume of business as there was last year and in part to uncertainty about the future. People generally are pretty badly muddled about what's going to happen in the next six months. It isn't likely that they will have any very serious afflictions but so long as they think they may, the result will be much the same.

Sales organizations generally are reporting that forward buying by manufacturers, wholesalers and retailers is at about the lowest point it has been for a year and a half. This is evidence that buyers are giving serious consideration to future price trends. It has been emphasized by downward tendencies in commodity and merchandise markets.

Sales of motor vehicles will be more difficult the latter half of the year than they were the first but they can be made if sufficient effort is exerted in the right places. There is likely to be considerable shifting of demand and the relative value of potential markets should be considered carefully. It has been assumed that agricultural sections would offer larger outlets than industrial centers but it may be necessary to revise this estimate.

There never can be evenly balanced, permanent prosperity in this country until the prices of farm products and of other commodities reach something approaching the same level. This does not mean that farm prices will go higher. To the contrary, other prices are much more likely to go lower. This will not be brought about by a steady recession but by a series of "ups" and "downs" over a period of years with each "down" a little lower than the one which preceded.

Farm prices are determined largely by export demand. This demand is sub-normal because financial exigencies in other countries have made it imperative for them to raise as large a part as possible of their food supply. They have made greater progress in this direction than they have in regaining their industrial equilibrium. There is no immediate prospect, therefore, of largely increased exports of farm products. As a consequence prices are not likely to rise much higher, unless there is a sharp curtailment of acreage all along the line, because production at present is larger than domestic needs.

Inasmuch as the public is giving such close attention to price considerations, motor vehicle manufacturers will be wise if they make the prices of new models as low as possible. Every time a farmer hears something he wants will cost him more money,

the grouch which has become more or less chronic, is aggravated, and an in-growing grouch is a terrible affliction. The farmer's city brother has acquired something of the same viewpoint in relation to prices.

Better Ventilated Closed Bodies

NOW that closed bodies are such a large factor in car sales and are so widely used for year-round service, the peculiar demands of such service should not be overlooked. Closed bodies need to be weather-tight, but they also must be well ventilated if they are to be comfortable under all circumstances.

Cowl ventilators are now common, even on open cars, but are hardly adequate under most weather conditions for ventilation of the entire interior of a closed model. Easily adjusted windshields are desirable as are also side windows with suitable regulators, yet even these do not give the open effect which is sometimes desired, especially in hot weather. Then why not fit the fourth side, the rear, with a window which is easily opened and closed?

Coachmakers say that such a window admits much dust and sometimes results in unpleasant draughts. Many users would like it, nevertheless. A goodly proportion of closed cars are seldom used on dusty roads. Furthermore, if the window is easy to open and close, as it should be, its disadvantages disappear when closed. Interiors are being made easier to clean so that objections on the score of dust are not difficult to overcome.

A top ventilator can be used to advantage in some cases, but it adds some complication and expense.

Ventilation is quite necessary also in cold weather. Fresh air must be admitted in sufficient quantity but without discomfort to passengers if possible. A properly designed ventilator will do this. It should not be difficult, either, to provide for heating incoming air if the additional expense is warranted.

A common fault with some cars is the foul smelling exhaust which often enters a closed body. Tight exhaust connections and muffler and a tailpipe of reasonable length, items which all cars should have no matter what form of body is used, will prevent most trouble on this score.

Lubrication for Racing Engines

UP to a few years ago, when the limitations on piston displacement of racing cars were not as drastic as they are today, these cars usually carried two men, a driver and a mechanic—or mechanician, as some called him. With the piston displacement reduced to 122 cu. in. it has become desirable to dispense with the mechanic, in order to keep up the speed, for his weight and the increased width of body required for properly seating him add materially to the resistance encountered by the car. This has given us the one-man racing car with which the public became acquainted at the Indianapolis race on Decoration Day and the Kansas City Speedway race on the Fourth of July.

The Kansas City race brought out a defect in the design of 122 cu. in. engines which should be remedied before the next big race is run, which consists in inadequate provision for the lubrication of the bearings. At Indianapolis no trouble from this cause was experienced, for, owing to the construction of that Speedway, it was necessary to slow down four times during every lap, which gave the bearings a chance to cool off a little. At Kansas City there was no need, so far as the track is concerned, to shut off the engines periodically, and as a result a pace was set from the start which caused the bearings on some of the engines to be burned out at an early stage of the race. The higher speed maintained at Kansas City is clearly reflected by the winner's average of 105.76 m.p.h.

It has been pointed out previously that the crankshafts of these little racing engines turn at speeds up to 5000 r.p.m., and at such terrific speeds the pressures on the bearings depend mainly on the inertia forces of the reciprocating parts, which increase as the square of the speed. Therefore, the strain on the bearings increases much faster than the average car speeds and the far more severe test to which the engine bearings were subjected at Kansas City becomes plain.

Various means for increasing the effectiveness of the oiling system suggest themselves. Lubricants that do not lose their viscosity readily at high temperature are most effective for high speed, high duty work, but presumably the contestants already used castor oil, which is the best engine lubricant from this point of view known at the present time. Increasing the amount of lubricant carried and the radiating surface which disposes of the heat accumulated by it on its passage through the engine may help. A further possible remedy would lie in the use of increased pressure on the oil fed to the bearings, because with increased pressure on the feed, additional load can be sustained on the bearings. If all of these remedies should prove inadequate the only course that remains open is to increase the sizes of the bearings.

What Real Service Means

"THE science of selling shows that, to get anywhere, we must be willing to serve—that service, and not the commodity, is the builder of sales—and further, that the product we sell, after it is sold, is still in a sense our product.

"Servicing is different from selling in that service is both an art and a science, or at least it should be. When it is, it is something real—something tangible—something which becomes and remains a definite part of the product during its life.

"If a purchaser's confidence in the product he has selected is more firmly established by the dealer's assurance of real service, there are good reasons why he should receive reliable information regarding the actual service which is open to him and the methods for getting that service when and where he needs it."

These paragraphs are taken from a little booklet sent out by the American Bosch Magneto Corp.

Industry Operating on Lower Schedules

Parts Makers Report Orders from Major Producers Running to December 1

NEW YORK, July 16—The industry is working on reduced schedules that show little change since their adoption the first of the month. Parts makers in some manufacturing centers report new business received covering the needs of major car producers to Dec. 1, with orders from smaller manufacturers limited to current requirements.

The period of factory readjustment which the industry has entered probably will carry well into next month and during this time no effort will be made to approach past production records. While manufacturers are progressing with their inventory taking, operating programs will be maintained at a mark sufficiently high to meet the dealer's immediate needs, but there will be no overstocking of him or at plants. Production, on the whole, will be kept at a comfortable pace without the straining of plant facilities.

Preparing Plants for Fall

This period is one of semi-annual occurrence and the curtailment of operations means nothing more than the placing of factories in fit condition for fall and winter activities. While car buying appears to be reaching a more normal level throughout the country, many districts continue to report heavy business. In no section has there been a falling off in sales that would lead to the impression of a definite decline in buying interest. Temporary, local conditions have been instrumental to a large extent for the lull in some areas, together with the fact that these areas had been purchasing cars in large volume for some months past.

Factories producing motor trucks are not likely to follow the course being pursued in automobile making plants, due to the fact that they have been operating on conservative schedules and expanding as improvement in general business conditions warranted. There is as yet no apparent slowing down in factory operations. The halt in building construction in parts of the country has had no appreciable effect on either sales or production and the continuance of good business is keeping the curve up in this branch of the industry.

Conditions in the export field are especially encouraging. The usual decline attendant upon the season, which marks the slowing down in buying in countries below the equator and is somewhat too early for active purchasing above it, is being felt only in a slight degree, months that should show a falling off reporting an exceptionally well sustained volume of sales. Because of the number of orders placed for delivery in succeeding months it is probable that the last half of the year will equal the first half in the amount of business transacted.

Some tire makers are lowering their schedules, but as with car producers, this is only a seasonal condition.

The situation with parts makers is satisfactory, with collections good and business well sustained.

Business in Brief

NEW YORK, July 19—Trade and industry showed a gradual decline last week. Some of this decline was seasonal and some doubtless was caused by the prevailing policy of caution. The outstanding favorable features of the week were the reported breaking of car loading records and a decline of 96 million in Federal Reserve system rediscounts.

Present indications are that there will be a gradual recession in business activity with a slight speeding up of orders in the fall and winter.

Steel orders have declined with the result that unfilled orders on the books have decreased about 600,000 tons. Pig iron prices have eased, and indications are that there may be lower prices for steel.

The outstanding unfavorable feature of the week was the falling of wheat prices below the dollar mark. Estimates of the total crop point to a large carry over and with European conditions such as to preclude large buying there is every likelihood that the farmer will not be able to recover the cost of production. This situation unquestionably will result in a smaller farmer buying capacity which will be felt in trade and industrial enterprise.

Car loadings for the week ending June 30 aggregated 1,021,770, an increase of 19,030 cars over the week previous.

Stock market trading was very light and irregular without showing any definite trend. An upward movement was registered by the bond market although the volume of business transacted was restricted.

New Interests Buy Control of Apperson

D. O. McCord and Maurice Rothschild Acquire Shares That Bankers Held

KOKOMO, IND., July 16—It was announced here today that a controlling interest in the common stock of the Apperson Brothers Automobile Co. has been purchased by D. O. McCord and Maurice Rothschild of New York. A directors' meeting has been called for Thursday at which the new owners of the controlling interest are expected to announce their policy.

The stock involved in the transaction was that deposited with the bankers who financed the company earlier in the year. It does not include any of the stock owned by the Appersons who, so far as is known, will continue with the business.

The announcement has created considerable surprise because of a refinancing last April which resulted in the floating of a bond issue of $700,000 and three-year debenture notes for $383,000, making a total of $1,083,000. This was used in funding the company's bank loans and materials account and providing a working fund for increased production. It was the first time the company had interested outside capital. Following the refinancing N. H. Van Sicklen was elected president of the company.

McCord is not unknown to the automotive industry. Originally with the Bankers' Commercial Security Co. of New York, he undertook the reorganization of the Standard Steel Car Co.

Travis Resigns as Head of Locomobile Division

NEW YORK, July 18—E. A. Travis, head of the Locomobile unit of Durant Motors, Inc., and for many years general sales manager of the Bridgeport concern, has resigned from the organization, effective Aug. 1. As yet he is not prepared to state his future plans.

Travis has maintained headquarters at New York for some time as assistant to the president, W. C. Durant, and only recently returned from a transcontinental trip during which he visited all the Locomobile branches, making a number of changes in personnel. Travis leaves Locomobile with a fine record made during the financial troubles of that company.

When the old Locomobile Co. went into a receivership Travis succeeded, on behalf of the largest creditors, in having the various branch managers named co-receivers in the various Federal districts so that car selling continued without interruption. The sale of the Locomobile properties to the Durant interests terminated the receivership.

Liberty Plant Sale Is Again Postponed

September 6 New Date—Plan to Unite with Columbia Still Under Way

DETROIT, July 17—Sale of the Liberty Motor Car Co. was postponed by the receiver today to Sept. 6 at the request of the creditors' committee, which desires the additional time to work out its plans for a reorganization. In the absence of any other interested bidders the receiver set the new date as requested, the sale to take place at the plant at 12 noon. There is no upset price.

The reorganization toward which creditors are working is that which would unite Liberty with Columbia and, although no official reports have been made on the progress of the plan, all preliminary steps indicate that it is favored by interested parties.

Business conditions are such that there is no necessity for the matter being pushed through to completion at once. Purchase in the fall would give the new owners an opportunity to realize immediately on fall business and also would permit changes that may be necessary for spring manufacturing.

The Liberty plant is the last manufacturing unit of any importance in this district to remain in receivership. C. H. Wills & Co. and Republic Truck are back in operation under private control. C. H. Wills spent a large part of last week in the East at conferences on the new company. Republic Truck is well on its way under the direction of O. W. Hayes.

Kentucky Wagon Planning to Iron Out Difficulties

LOUISVILLE, KY., July 17—That the officials of the Kentucky Wagon Manufacturing Co. have several methods, any one of which would be successful, to straighten out the company's tangled finances insofar as creditors are concerned, was indicated by James R. Duffin, attorney for the company, at a hearing before Judge George Du Relle, referee in bankruptcy.

One plan of action, Duffin announced, will be taken next week when the National Motors Corp., with which the Kentucky Wagon Manufacturing Co. merged about a year ago, will issue $2,100,000 in debenture notes, out of which $661,000 in unsecured claims against the local company will be safeguarded.

The hearing was on the question of whether Judge Du Relle should make permanent a temporary order issued last week restraining the Fisk Tire & Rubber Co. from selling property of the company to satisfy a judgment for the amount of its claim of $38,000.

After crossfire of attorneys for the wagon company and for the three creditors who filed an involuntary petition in bankruptcy against the company, Judge Du Relle took under advisement until next Friday afternoon the question of making the restraining order permanent and also the request of Percy Booth, attorney for the Fisk company, that the petitioning creditors be required to post bond of $38,000, the amount of the Fisk company claim to save possible danger of loss to his client.

Holding Back of Steel Releases Is to Be Expected During Period of Inventory Taking

By D. E. PERRY

of the Hayes Manufacturing Co.

Detroit, July 18.

REDUCTION of back orders for steel as indicated in the recent report of the United States Steel Corp. has no particular bearing in its significance upon the automotive industry other than the steel industry has caught up on orders it was unable to fill up to this time and is now operating on current business.

Due to the expected change in models by a number of the largest producing companies, and also to the fact that all companies in the industry are balancing up their inventories now, there is a general holding back of releases. In all likelihood there will be another concentration of shipping orders early in September which will again have the effect, if in a lesser degree than in the early part of the year, of creating a temporary shortage and a scurrying for warehoused stocks.

There is nothing in the business situation that would indicate any important falling off in automobile buying in the latter part of the year. Releases to parts makers now are somewhat confined owing to reasons indicated above, but the leaders in the industry are outlining commitments on a scale that would indicate no apprehension is felt over the continuance of large business.

The falling off in business which was predicted in so many sources for the summer months of this year has failed to materialize any more than it did in the summer months of last year. Manufacturing schedules of leading companies for these two months show nothing that might be interpreted as a falling off. Companies bringing out new models have been holding off in specifications but that is due to the clearing out of old stock and final determination on the new material to be required.

There will be no change in steel prices of any importance in the remainder of the year. Deliveries now are easy and many of the steel mills are taking advantage of the season to overhaul equipment. Concentration of orders around September will lengthen out time necessary for deliveries.

The eight-hour day in the steel industry, if it comes, will have little if any effect on the automotive industry, that I can see. It is impossible to make any prediction on it, but if it is adopted I do not believe it will be at the instigation of the men actually employed in the mills.

On the general business situation for the balance of the year I can see no reason why it shouldn't be good. The only group about whose stability there is any mystery is the farm group and it is far from being a settled question in my opinion that there will be heavy buying from the farms this year. Prices of things the farmer has to sell show a continued dwindling, while prices on most things he would buy show an increase. It is not logical to expect that he will be a large buyer under these circumstances. Outside of the farm group, however, there are sound conditions which augur well for continued business.

Duval May Drop Action for National Receiver

INDIANAPOLIS, July 18—The hearing of the receivership proceedings against the National Motors Corp. and the old National Motor Car & Vehicle Corp., instituted by W. H. Duval & Sons of New York, has been postponed.

It is understood that the claim on which the suit was brought is in process of adjustment and that the probabilities are the receivership suit may be dropped.

Pacific Steamers Carry More Cars to Far East

SEATTLE, WASH., July 18—When the steamer, President Madison, of the Admiral Oriental Line sailed for the Orient June 19, she carried 200 automobiles of various makes, of which more than 50 per cent were Buicks.

The manifests of this steamship line show that its five passenger liners, the President Madison, President Jackson, President McKinley, President Jefferson and President Grant, one of which sails every twelve days for the Far East, are carrying a larger number of cars than a year ago.

PAN TO BE SOLD AUGUST 1

ST. CLOUD, MINN., July 16—Announcement is made that there will be a receiver's sale of the properties of the Pan Motor Co. Aug. 1.

Timken Axle Obtains Standard Equipment

Company Will Continue Under Present Name and Without Change in Management

DETROIT, July 17—The Standard Equipment Co. of Cleveland has been taken over by the Timken-Detroit Axle Co. through the purchase of all outstanding preferred and common stock, but will continue to operate as an independent corporation under its present name and management.

The company will be continued as a complete axle building organization, its product continuing under its own name, and it will build parts for the Detroit plants as formerly. The Detroit plants will also build parts for the Cleveland organization.

In a statement on the purchase, Fred Glover, president and general manager of Timken, says:

> Cleveland is second only to Detroit in the importance of its automotive industry, and it seems only logical to us for the Timken company to establish a plant in this important market through which it can more easily serve a number of its important customers.
>
> The Standard Equipment Co. has already established an enviable reputation for the quality of its workmanship and we believe through its experience during the past year in the manufacture of complete axles for such cars as Peerless and Lafayette, together with gears and differentials for many car and axle manufacturers, that we have acquired an asset of value not only to ourselves but to the trade in general.

The purchase gives Timken a manufacturing unit which materially supplements its facilities for the production of complete passenger car axles and also insures an additional source of supply for bevel gears, differentials and drop forgings, three important items in axle construction that have heretofore proved limiting factors under stress of heavy production, Glover says.

Officers in charge of Standard Equipment are A. J. Ashman, vice-president and general manager, and D. F. Domizi, in charge of engineering and production. It is contemplated that the board of directors will be identical with that of Timken.

Olds Offers Personnel to Draft Traffic Rules

DETROIT, July 18—Olds Motor Works is placing its entire facilities and personnel at the service of all State and municipal officers throughout the country, who desire the cooperation of active factory experts in the drafting of efficient traffic regulations.

Members of its dealer organization are urged to participate actively in traffic matters that may come up in their territories, and to advise the factory where factory assistance can be given.

G. H. Peasley, general sales manager, will be the chief factory executive in directing Olds efforts toward better traffic conditions. Discussing the question, he said that it is time for the automobile manufacturer and public official to get together. The interests in the matter are identical, he said, and there is no doubt but that the car maker must participate if a solution is to be reached. Through cooperation traffic regulations can be evolved which will not be detrimental to the interests of the manufacturer.

Citing ways in which the factory could help, he said that engineers can give accurate information on speeds and brake capacities. Traffic experts and field representatives, he stated, can assist by furnishing information on laws and regulations which have been found effective in other cities under similar conditions.

Oshkosh Truck Will Get Greater Working Capital

OSHKOSH, WIS., July 16—Production of Oshkosh Four-Wheel Drive trucks is again in the ascendancy, following refinancing to obtain a more adequate working capital, whereby the financial solidarity of the industry also is enhanced.

An issue of $100,000 first mortgage bonds has been authorized. Of this amount, $75,000 will be employed to wipe out a land contract for $125,000, issued when the factory building was erected by the Citizens Building Co., which already has received $50,000 on account. The remaining $25,000 of the mortgage issue proceeds, together with the retirement of stock in the building company, will give the truck company about $35,000 more working capital.

It is pointed out that the equipment of the factory, which costs about $85,000, has made the security behind the mortgage issue much greater than that which represented guaranty of the land contract in the first instance.

Four-Wheel Drive Truck to Be Built at Nashville

NASHVILLE, TENN., July 18—A factory for the manufacture of motor trucks and motor buses is to be established at the Old Hickory plant, near Nashville, which was used as a Government manufacturing site during the war, by the M. B. Automotive Corp., formed recently under the laws of Delaware.

Guy Hamilton and M. B. Bollstrom, officials of the company, have been here this month investigating the proposed location of the plant and have stated definitely that it will be established at Old Hickory. Eight buildings have been leased to house the plant and the general offices.

The type of truck to be built is unusual in that it will be a front wheel drive gasoline vehicle.

It is expected that manufacturing operations will begin at the plant some time during the present summer.

Mercer Motors Put in Receivers' Hands

Action Follows Filing of Bankruptcy Petition by Three Creditors

TRENTON, N. J., July 16—Bentley H. Pope, vice-president of the Capital City Trust Co., and William A. Smith, vice-president of the Mercer Motors Co. of this city, have been appointed receivers for the Mercer company under a $25,000 bond, and given power to operate the company for a limited time.

This action on the part of Federal Judge Runyon followed the filing of an involuntary bankruptcy petition in the United States District Court by three of the company's creditors with claims aggregating $21,000. The Mercer company is given until July 28 to answer this suit. The creditors filing the petition are the C. H. Wheeler Manufacturing Co., which claims $3,933; the Rochester Motors Co., $17,000, and the Trenton Electric Supply Co., $103.

Smith, who has been identified with the Mercer company for the last eleven years, is hopeful of straightening out the financial difficulties of the company, which date back to October, 1919, when it became part of Hare's Motors. After the combination was dissolved, the Mercer company was controlled by creditors and banking interests, first under the direction of T. E. A. Bartel, representing the banks, and later with R. N. Barnum at the head. Since last May Smith has been in charge.

Reorganized in 1919

Originally known as the Mercer Automobile Co., a reorganization was effected in 1919, when the name was changed to Mercer Motors Co., with a capital stock of 200,000 shares of common stock of no par value, of which 100,000 shares were held in a voting trust agreement which expires Aug. 1, 1926. When 89,000 shares of common were publicly offered in October, 1919, the price was $40 a share. The company had a funded debt of $500,000 first sinking fund gold 8 per cents, dated June 1, 1921, and due June 1, 1941, and $1,491,800 in four-year 7 per cent sinking fund collateral notes dated Aug. 1, 1921, and due Aug. 1, 1925.

At one time the Mercer company also owned the outstanding stock of the Simplex Automobile Co., but this was disposed of last winter, when a new company was formed to make the car.

TRUCK HEADQUARTERS MOVED

DETROIT, July 17—The headquarters of Motor Truck Industries, Inc., have been moved from the Book Building to the Capitol Building, this city, where more commodious accommodations will be afforded. The directors' meeting scheduled for this week will be the first held in the new quarters.

Miller Plans Stock Car and New Engine

Former Will Be Built on Special Order Only—Latter Will Be Four-Cylinder

LOS ANGELES, July 17—Announcement is made that Harry A. Miller, who built the H. C. S. Special which won the Indianapolis speedway race, driven by Tommy Milton, and the Durant Specials that are now campaigning the speed meets of the country, will build stock cars powered by a Miller engine of 183 cu. in. piston displacement.

The car will be built on special order only. It will be known as the "Miller Vertical Eight." The cars will be equipped with strictly custom-made bodies, built according to the specifications of the buyers, and the price will exceed $10,000.

Miller has completed designs for the stock car chassis and has let a contract for a limited number of bodies to a local coach-building concern. The intention is to build but twenty-five cars annually. There will be no production this year, as Miller will devote all his time to racing.

It is announced also that Miller intends to produce a four-cylinder engine of his own design for use on a chassis with a wheelbase of only 100 in. He says the car will average 50 miles to the gallon of gasoline and the selling price will be under $2,000.

Miller Racer Sent Abroad

LOS ANGELES, July 16—The Miller Engine Works has shipped to England the racing car it built here for Count Louis Sborowski for entry in the Italian grand prize race at Monza Sept 9. The company is building two more of these cars, one for Martin Alzaga and the other for Jimmy Murphy, both of which will be shipped to Italy for entry in the Monza race. It is understood that these cars will be entered as Miller Specials.

Light Testing Measure Is Vetoed in Wisconsin

MILWAUKEE, July 16—Although agreeing in principle with the idea of establishing municipal stations to test lighting equipment of motor vehicles, Governor Blaine of Wisconsin has vetoed the act of the Legislature because, he says, it encroaches upon and endangers personal liberty.

The bill provided that whenever any sheriff or police officer in the municipality where the testing station is located believes the lighting equipment, or its adjustment, does not conform to the law, he shall direct the owner to subject it to the test within five days, and if the owner fails to do so, he shall be arrested and fined. The veto message says:

The vice of the measure is this—that a person may have his car lights in perfect condition; he may be going through the county, city or village and be directed to go to the station for adjustment. Under this bill, if he refuses, he is guilty of a misdemeanor and subject to a fine. In other words, a man's liberty, character and reputation may depend upon the whim, caprice or even prejudice of a policeman. Moveover, a person's liberty should not be put in jeopardy for violating what a police officer may say he directed.

G. M. Forms Subsidiary for Development Work

DETROIT, July 18—Moraine Products Co. has been formed as a subsidiary of General Motors Corp. to act as a company for the further development of products which have passed the experimental laboratory stage, but which have not reached the point where they can be placed in regular production in any of the main manufacturing units.

The company is located in Dayton and will be operated under the direction of C. F. Kettering, who is also president of the General Motors Research Corp. The name "Moraine" is geographical, having reference only to the part of Dayton in which the plant is located. All products of the experimental laboratories which are not ready for the regular production plants will pass, in the process of their development, through the Moraine company.

Aitken Heads Interests Buying Clymer Spotlight

DENVER, July 16—Controlling interest in the Clymer Spotlight Co. of this city has been purchased by interests headed by R. M. Aitken, formerly president of the Mountain and Gulf Oil Co., and the name of the concern changed to the Clymer Manufacturing Co.

Aitken has been elected president, while the vice-president is H. H. Brooks, formerly vice-president of the International Trust Co. of Denver and now secretary and treasurer of the Midwest Oil Co. A. A. Schneiderhahn, president of the Midwest Auto Supply Co., is secretary and general manager, and Albert Kline, comptroller of the Midwest Oil Co., treasurer.

Other members of the board are L. L. Aitken, president of the Midwest Oil Co. and president of the Salt Lake Producers Association, and Ralph Hartzell, a Denver attorney.

NO LET-UP WITH ROLLS-ROYCE

SPRINGFIELD, MASS., July 18—Rolls-Royce production is going forward without abatement this month, between nine and ten complete cars being produced each week. There is no indication of an August slack in the output.

AUTO-LITE CLUB HOUSE OPENS

TOLEDO, July 18—The Electric Auto-Lite Co. has just opened its new club house for employees. Nearly 150 employees are members of the club.

Two Aircraft Bodies Choose New Officers

Russell Heads Aeronautical Chamber and Rentschler, Manufacturers' Association

NEW YORK, July 16.—Annual meetings of the Aeronautical Chamber of Commerce of America and the Manufacturers' Aircraft Association were both held the same afternoon last week. F. H. Russell, vice-president of the Curtiss Aeroplane & Motor Corp. of Garden City, L. I., being chosen president of the former and F. B. Rentschler, head of the Wright Aeronautical Corp. of Paterson, N. J., president of the latter.

The chamber, reporting 216 members, an increase of 25 per cent in the last year, named the following officers:

President, F. H. Russell, vice-president, Curtiss Aeroplane & Motor Corp., Garden City, L. I.; first vice-president, Allen Jackson, vice-president, Standard Oil Co. of Indiana, Chicago; second vice-president, S. M. Fairchild, president, Fairchild Aerial Corp., New York; third vice-president, Donald Douglas, president, Douglas Co., Santa Monica, Cal.; treasurer, Charles H. Colvin, general manager, Pioneer Instrument Co., Brooklyn; secretary, Luther K. Bell, New York; assistant secretary, Owen A. Shannon, New York.

In addition the following were elected to the board of directors:

W. C. Young, Goodyear Tire & Rubber Co., Akron; I. M. Uppercu, Aeromarine Plane & Motor Co., Keyport, N. J.; Grover C. Loening, Loening Aeronautical Engineering Corp., Paterson, N. J.; B. D. Thomas, Thomas-Morse Aircraft Corp., Ithaca, N. Y.; F. B. Rentschler, Wright Aeronautical Corp., Paterson, N. J.; Lawrence B. Sperry, Sperry Aircraft Corp., Farmingdale, L. I.; John M. Larsen, J.-L. Aircraft Corp., New York; J. G. Vincent, Packard Motor Car Co., Detroit and E. A. Johnson, Johnson Airplane & Supply Co.

Aircraft Association Elects

The election of the Manufacturers' Aircraft Association resulted as follows:

President, F. B. Rentschler, president, Wright Aeronautical Corp., Paterson, N. J.; vice-president, Glenn L. Martin, president, Glenn L. Martin Co., Cleveland; treasurer, Frank H. Russell, vice-president, Curtiss Aeroplane & Motor Corp., New York; secretary, Chance Vought, president, Chance Vought Corp., Long Island City; general manager and assistant secretary, S. S. Bradley; directors, A. H. Flint, L-W-F-Engineering Corp., College Point, L. I.; F. L. Morse, Thomas-Morse Aircraft Corp., Ithaca, N. Y.; J. K. Robinson, Jr., Gallaudet Aircraft Corp., East Greenwich, R. I.; I. M. Uppercu Aeromarine Plane & Motor Co., Keyport, N. J. and A. J. Elias, G. Elias & Brother, Buffalo.

CAR LINE TO DETROIT PLANTS

DETROIT, July 14—The Cadillac Motor Car Co. has offered to purchase $500,000 of Detroit Street Railway bonds to finance the construction of a car line for the relief of traffic to and from west side plants.

Government Charges Monopoly in Bumpers

Sherman Act Basis for Suit Filed In New York Against Eleven Manufacturers

NEW YORK, July 17—A bill in equity filed in the Federal Court by Special United States Attorneys David A. L'Esperance and R. W. Joyce asks for an injunction restraining the American Chain Co. and ten other manufacturers of loop-end spring bar bumpers from "continuing methods threatening to result in a monopoly of the entire trade in automobile bumpers in the United States." It is expected the defendants will answer within twenty days and the case come up for hearing some time next winter.

Other Companies Mentioned

The Government names, in addition to the American Chain Co., ten manufacturing concerns which are claimed to be licensees of that company under the bumper patents issued to Rollie B. Fageol, Thomas A. Hoover and William J. Pancoast and William J. Grotenhuis as follows:

Gemco Manufacturing Co., Milwaukee; L. P. Halladay Co., Decatur, Ill., Biflex Products Co., Waukegan, Ill.; Allith-Prouty Co., Danville, Ill.; Wolverine Bumper & Specialty Co., Grand Rapids, Mich.; New Era Spring & Specialty Co., Grand Rapids; American Metal Parts Manufacturing Co., Milwaukee; Bellevue Manufacturing Co., Bellevue, Ohio; C. G. Spring Co., Kalamazoo, Mich., and the Bilt-Right Products Co., Danville, Ohio.

It is contended that American Chain, controlling the Fageol, Hoover and Pancoast-Grotenhuis patents, has licensed the ten concerns named above to manufacture the loop-end spring bar bumpers as defined by these patents on a royalty basis and that the agreement entered into with each licensee calls for maintaining uniform prices, minimum gross sale price and uniform trade discounts and cash discounts along with the fixed resale price. It also is claimed that the agreement stipulates that the licensor and the licensee shall fix a minimum profit for themselves of not less than 10 per cent more than the cost of producing and marketing the bumpers.

Charges Sherman Act Violation

The Government claims that this alleged conspiracy in restraint of trade was commenced prior to Jan. 1, 1920, and that it is contrary to the Act of Congress of July 2, 1890, entitled "An Act to Protect Trade and Commerce Against Unlawful Restraints and Monopolies." It is charged that through American Chain gaining control of patents numbered 1,202,690, 1,191,306 and 1,374,893, it can control at least 60 per cent of the trade and that if it is successful in the litigation now going on it will control the entire trade, amounting to more than $20,000,000 a year.

Accompanying the bill and in the nature of an exhibit is a copy of the agreement said to have been entered into with the Gemco Manufacturing Co., which is declared to be similar to those entered into with the nine others named.

Lashar Makes Statement

Following the filing of the suit, Walter B. Lashar, president of the American Chain Co., issued the following statement:

The government suit will not only clarify our own right but the rights of other patentees. Anybody can make automobile bumpers, but we have patents covering a particular kind of spring bar bumper, and if we attained a monopoly, as feared by the government, it would be only because automobilists prefer this kind of bumper to all others. Clarification of the whole situation is necessary.

The American Chain Co., Inc., originally acquired for its own use several patents covering spring bar bumpers and has since licensed eleven other manufacturers to produce these bumpers. The nature of the licenses issued by the Chain company has been well known in the trade and to the government practically since the license policy was adopted, and their terms are such as to safeguard the quality of all bumpers produced.

The American Chain Co. enjoys, in fact, no monopoly of manufacture and only the monopoly of sale which is brought about by the preference of the public for this kind of bumper. The question at issue concerns the rights of a patentee to produce his own patented article and to license others to produce the same under restrictions designed to insure quality

There could be no question in the mind of the government as to the right of the American Chain Co. to produce its own patented article, which would be a legal monopoly in fact, and the present suit has arisen because others were licensed to produce under the American Chain patents.

New Wills Sainte Claire Files Papers in Boston

BOSTON, July 17—Wills Sainte Claire, Inc., of Boston and Marysville, Mich., is the title selected for the new corporation which has succeeded C. H. Wills & Co. as manufacturer of Wills Sainte Claire cars.

Incorporation papers have been filed with the Secretary of State by President Asa Burton Nelson of Cambridge, Treasurer D. S. Carpenter of Winchester and Clerk J. C. Rice of Dedham. The authorized capital of the company was given as $15,000,000, represented by 50,000 shares of 7 per cent cumulative preferred, 500,000 shares of 6 per cent cumulative first preferred, 50,000 shares of 6 per cent second preferred, all of $100 par, and 400,000 shares of common of no par value.

$25,000 McFARLAN SOLD

CHICAGO, July 18—The gold plated McFarlan car, which was bought from the factory by Harris & Rodgers, Chicago automobile dealer, and exhibited at the National Automobile Show last winter, has been sold for $25,000 cash. The purchaser was a woman from Oklahoma City whose family acquired wealth from oil.

M.A.M.A. Convention Committees Selected

Association Is Getting in Readiness for Meeting in Boston in September

NEW YORK, July 18—Two committees have been appointed by General Manager M. L. Heminway of the Motor and Accessory Manufacturers' Association to work on plans for the fall convention which will be held at Boston, Sept. 19-22. The Boston committee on arrangements consists of the following members:

F. T. Moore, district manager of the B. F. Goodrich Co., chairman; J. P. Hach, traffic manager of the L. C. Chase Co.; T. H. Dumper, treasurer of the F. S. Carr Co.; H. K. Johnson, F. S. Carr Co.; W. N. Lorenz, Boston manager of the Willard Storage Battery Co. and E. J. Moses of the Gray & Davis Co.

General Program Committee

The general program committee is made up of the following members:

J. M. McComb, vice-president of the Crucible Steel Co. of America; Maurice Switzer, vice-president of the Kelly-Springfield Tire Co.; S. W. Dorman, vice-president and general manager of the Overseas Motor Service Corp.; E. P. Chalfant, chairman of the Gill Manufacturing Co.; P. C. Gunion, advertising manager of the Hyatt Roller Bearing Co.

B. M. Asch, president of Asch & Co.; H. W. Angevine, treasurer of the Hyatt Roller Bearing Co.; A. Pauli, credit manager of S.K.F. Industries; M. L. Heminway, general manager of the Motor and Accessory Manufacturers Association; C. A. Burrell, manager of the credit department of the association; H. Duester, manager of the traffic department and M. Lincoln Schuster, manager of the educational department.

Yellow Cab Will Issue 400,000 Shares of Stock

CHICAGO, July 18—A plan to increase the capitalization of the Yellow Cab Manufacturing Co. by $5,000,000 was approved yesterday at a meeting of the board of directors.

The plan calls for the issuance of 400,000 shares of new stock of $10 par value to be sold at $12.50 a share, only present stockholders being privileged to purchase these shares at the rate of two for each share now held. The outstanding stock is 20,000 shares of $10 par value, but these shares have been selling in excess of $225 a share.

The directors voted to establish a dividend rate of $5 a share on the new capitalization, which is equivalent to $15 a share on original stock.

Earnings of the company for the first six months of this year were reported to be $2,062,585. It is understood that some of the new capital will be used to establish a subsidiary to finance the sale of cabs on deferred payments. Stockholders are expected to approve this plan.

New Peruvian Tariff Lowers Duty on Cars

Indications Are That Automobile Prices Will Be Greatly Reduced As Result

WASHINGTON, July 16—Automotive equipment imported into Peru are subject to a tax of approximately 15 per cent ad valorem duty, according to the new tariff rates which became effective July 1, and which have been forwarded to the United States Department of Commerce.

Schedule number 1502 of the new rate provides for a tariff duty of 0.01 per cent per sol (eq. $0.48) gross per kilo of 2.2 pounds.

On passenger cars the rate is 15 per cent ad valorem on vehicles valued up to 500 Peruvian pounds (pound eq. $4.86 at normal exchange); on passenger cars valued at from 500 Peruvian pounds up to 1500 pounds, the tariff is 25 per cent ad valorem and over 1500 pounds, a rate of 35 per cent is assessed.

A fine of 25 per cent ad valorem on parcel-post packages not accompanied by consular invoices has been reimposed by decree of the Minister of Hacienda, dated June 30.

Automobiles Held as Essential

NEW YORK, July 17—The new Peruvian tariff is designed to build up agriculture and industry in that country. Products which are or can be manufactured in the country are given a higher duty than formerly, but other products, which are needed and which must be imported, are placed under greatly reduced schedules. Automobiles are among the essential products given lower duties, as the government recognizes the necessity of building up further and more adequate transportation services throughout all parts of the country.

Advices received here today from Lima by *El Automovil Americano*, the Spanish automotive publication of the Class Journal Co., show that automobile prices in Peru will be greatly reduced by the new tariff.

Ford Announces Decreases

On July 3, just after the tariff was promulgated, the Ford distributors in Lima advertised drastic price decreases, the phaeton being lowered from Lp280 (pounds Peruvian) to Lp 210, this being the retail price at Lima, Ica, Pisco, Chincha, Canete, Chiclayo, Trujillo and Paita. The reduction of Lp70, at the current rate of exchange, is equivalent to approximately $294. The Ford truck chassis was reduced from Lp225 to Lp180, a cut of approximately $189, and the Fordson tractor was priced at Lp195.

Other reductions had not been made at the date of the last advices, but it was stated that many decreases could be expected. The duties on one of the popular four-cylinder cars which list slightly below $1,000, will be lowered, it was said, from about Lp120 to Lp50.

In expectation of the new tariffs, automotive imports into Peru have been small for some months. A change is expected, however, and a pick-up in sales is confidently expected. A number of new roads have been built recently in the provinces and the rural use of automobiles has extended rapidly. These factors indicate a larger business in automotive lines.

Collins Made Defendant in Stockholder's Action

CLEVELAND, July 17—David L. Rockwell of Cleveland, a stockholder, has filed two suits in the Common Pleas Court in this city, in one of which he asks the court to direct Richard H. Collins, president of the Peerless Motor Car Co., operating company, and the Peerless Truck & Motor Corp., holding organization, to account to the corporations for all money paid him for designing a new car, and in the other suit he asks the court to render judgment against Collins for "hundreds of thousands of dollars" alleged to have been paid him under a bonus agreement. Under this agreement, it is stated, Collins was to receive $65 for every Peerless car manufactured.

Gardner Motor Announces Changes in Sedan Model

ST. LOUIS, July 18—Gardner Motor Co. has announced a new sedan, the body construction of which is very much the same as the previous sedan model. There have been several changes in dimensions, body lines, outside finish and upholstery.

The seats have been widened, deepened and lowered. The back of the front seat is cut out, giving more room in the tonneau. The contour of the hood, cowl and radiator is rounded in place of the straight line effect as in the previous model.

The most distinctive change is in the outside body finish, which is Crane-Simplex duotone and in the upholstery of blue striped cut velvet. The inside body hardware is of Colonial design in special silver finish.

This new model is built on the one-chassis standard to all Gardner models and is driven by a five-bearing crankshaft Gardner motor.

Hendee District Sales Meeting Held at Plant

SPRINGFIELD, MASS., July 16—District sales managers for the Hendee Manufacturing Co. have concluded a week's convention at the plant here, during which they familiarized themselves with the 1924 models and the general construction of the product and joined in discussions of sales plans for the year.

Chief Engineer Hoffman led in discussions of mechanical subjects, while Sales Manager J. B. McNaughton gave talks on the sales campaign.

Store-Door Delivery Cuts Costs in Half

Port of New York Authority Cites Instance in Brief Filed with I. C. C.

NEW YORK, July 17—Approval of store-door delivery is found in the brief filed with the Interstate Commerce Commission by the Port of New York Authority, which claims that millions of dollars would be saved annually through the adoption of a scientific system of drayage from railroads centering on the waters of New York.

The Authority points to the success attained by the Erie Railroad through the use of store-door delivery by which the terminal service charge has been cut from $3 to $1.40 a ton through the use of motor trucks. The Erie turns over all its business to the United States Trucking Corp.

The brief does not criticize the arrangement between the Erie and the United States Trucking Corp. except to say that it does not go far enough and asserts that the Port Authority's plan for the unification of the terminal facilities would extend to shippers over other roads the advantage now possessed by those patronizing the Erie.

As planned by the Port Authority, it is proposed to extend these benefits to all shippers in the port district, the claim being that this will give the following undisputed advantages:

1—It will save the railroads large sums of money annually.

2—It will save shippers and consignees the difference between 12 cents per 100 pounds and 5 cents per 100 pounds. On the millions of tons of traffic trucked annually at the Port of New York this saving will be tremendous.

3—It will effect delivery of freight at points convenient to consignees.

4—It will relieve the congested waterfront on the west side of Manhattan Island.

5—It will extend to other trucking companies the benefits now confined to one large trucking concern.

Yellow's New Buses Make Appearance in Chicago

CHICAGO, July 16—The first of the new buses being built by the Yellow Coach Manufacturing Co. went into service here today. About 600 are to be built for service on Chicago boulevards.

The new vehicles are equipped with stoplights, headlights and many extras. They have three sets of brakes, two operating on the rear wheels and one on the front wheels. Rubber shock insulators and improved springs, in addition to individual seat springs, tend toward comfort of the passengers.

A three-speed silent chain drive, with transmission especially adapted to use on the level streets of Chicago, is used. The buses seat twenty-eight passengers inside and thirty-nine on the upper deck.

Parts Curve Shows Renewed Purchasing

Leading Car Manufacturers Place Orders that Cover Needs to December 1

MILWAUKEE, July 16—Demands upon manufacturers of automotive parts and equipment have shown an inclined curve during the past week, following a drooping trend during the last half of June, presumably while the industries were letting down activities to a certain extent while policies and schedules for the remainder of the year were being fixed.

Definite announcements by the leading manufacturers of passenger cars concerning their future production were preceded by the placement of new volume orders with unit and parts makers, which, as a rule, cover prospective needs up to Nov. 1 or Dec. 1.

Passenger car factories in this territory generally are striving to sustain production schedules at the high point, which is a difficult matter in view of the scarcity of skilled as well as common labor. There has been much bidding for labor at premiums among industries and between various manufacturing centers which has caused an abnormal turnover and accentuated the shortage of men. Many industries are not lumping their vacations this year, preferring to recess individuals in a progressive manner, so that production will not be omitted entirely and delivery specifications can be met regularly.

About the only change noted by some members of the industry is that orders for units and parts from some of the smaller makers are not of the same extended character as in the first half of the year, being mainly for current or nearby shipments rather than of the standing order kind covering three to six months.

Studebaker Sold 81,800 Cars in First Half of Year

SOUTH BEND, July 16—Studebaker Corp. announced that sales for the first six months totaled 81,800 cars. This is an increase of 36 per cent over the best previous six months' business in Studebaker history—that of 1922, when a total of 60,053 was sold.

Compared with sales for the entire year of 1918, the half-year record of 1923 shows an increase of 243 per cent. It is 108 per cent greater than sales for the full twelve months of 1919, and exceeds the sales for the full year 1920 by 59 per cent. It is 23 per cent greater than the sales for the complete year of 1921.

FORD SAWMILL ACTIVE

MILWAUKEE, July 16—The big sawmill and body factory of the Ford-owned Michigan Land, Lumber & Iron Co. at Iron Mountain, Mich., has been placed on a 24-hour operating basis, with three 8-hour shifts and with more than 2000 employed. At the same time work is being pushed on additional mills, new body shop units, power plant additions, a new hydroelectric generating unit and other extensions, which wil cost over $5,000,000 and require more than a year to complete.

TRUCK USE MUST GROW, RAIL EXECUTIVE SAYS

MILWAUKEE, July 16—"Railroads will soon be forced to establish terminals outside of congested cities and districts and convey all freight to destination by motor truck," said F. W. Urbahns, divisional superintendent of the "Soo Line" railroad at Fond du Lac, Wis., before a special meeting of the Fond du Lac Association of Commerce to consider transportation difficulties.

Urbahns said that railroads were prevented in their effort to provide rapid deliveries by the fact that in the cities large buildings have grown up alongside railroad right-of-ways, and it is impossible to expand terminal facilities. The condition ultimately will result in the establishment of freight centers outside of the congested districts, where rapid movement of freight is impossible, and dependence upon motor trucks to bridge the gap between terminal and consumer.

Jorgenson Primer Works May Be Put in Operation

WAUPACA, WIS., July 16—The old Jorgenson primer works, taken over after the failure of the Jorgenson Manufacturing Co. by the Acme Brass & Metal Works, probably will be placed in full operation shortly.

A large Chicago concern, the identity of which has not been revealed, has taken an option on the property, which is valued at more than $150,000 and is admirably equipped for making brass castings, gas engine priming devices, aluminum parts, piston rings and other automotive specialties.

The negotiations hinge on the willingness of Acme stockholders to accept stock in the Chicago company as part payment.

TERNSTEDT SHIPS TEN CARLOADS

DETROIT, July 17—The Ternstedt Manufacturing Co., maker of automobile body hardware, reports that its sixteen plants are running full capacity, with no signs of a lull. On one day this month the company shipped ten full carloads of body hardware to eight different destinations, 90 per cent of the product being for closed bodies.

Indianapolis Plants to Increase Output

National Sales Contests Keeping Up Sales with Several of the Producers

INDIANAPOLIS, July 18—Increases in production schedules over the June marks are reported in a number of automobile manufacturing plants here.

Duesenberg, Cole, H.C.S., Marmon, Premier and Stutz are expected to make greater shipments this month than last. Due to changes in three body styles and some shortage in materials, production at the Duesenberg plant in June declined over May, but greater activities will be the rule this month. H.C.S., which began producing its new "six" in May, expects shipments of these and its "four" to step-up this month.

Cole, with a new series, has experienced some delay due to shortage of materials, but reports that large shipments will be made this month. Marmon, with a national sales contest, reports increased retail selling over June and expects to establish shipping records for August, if the present sales pace is maintained.

Premier, with its reorganized company and its taxicab business, is increasing production. Renewed efforts are being made on the passenger car, and new dealers are being added.

Stutz is expanding production on its "six," introduced in the spring, and reports that the new sport job is helping keep a good flow of orders coming into the factory. In the case of Stutz the effects of a sales contest are still being felt. Although this contest ended May 31, salesmen state that they have a good many prospects whom they are developing into purchasers.

Demand for Ash Heavy; Prices Moving Upward

ATLANTA, July 17—Lumber manufacturers in Atlanta advise that there has been an unprecedented demand since the first of July for white ash at the various southeastern mills from the automobile and body trades of the North, and that July will establish a record for this year if the demand continues as steady through the rest of the month.

The first six months of the year witnessed the largest volume of ash and maple sales to the automobile and body trades in the history of the southern lumber industry over a six-month period. As a result of the steady demand, a tendency upward in prices is noted.

The average of the Atlanta market, f.o.b., for 10/4, better grade of firsts and seconds, is $120; and for No. 1 Common, $80. For 12/4, better grade of firsts and seconds, the average is $123; and for No. 1 Common, $85. These are the two dimensions now principally in demand from the automobile trades.

1,050,185 Ford Units Built in Six Months

Company Expects to Complete Year with 1,800,000 Cars and Trucks Sold

DETROIT, July 17—Ford production in all units for the first six months of the year totaled 1,050,185, divided, according to the various divisions, as follows: Ford cars and trucks, domestic and foreign (exclusive of Canada), 941,245; Canada, 46,871; Fordson tractors, 58,557, and Lincoln cars, 3512.

Basing its opinion on present prosperous conditions and the outlook for general business during the balance of the year, the company anticipates completing the year with about 1,800,000 cars and trucks for domestic use alone.

The figures for the first six months represent the biggest volume of business the company has ever done. New production records have been set every month since January by the domestic plants, June completing the half-year period with 175,040, which exceeds the May output by nearly 5000. Production, it is declared, will be increased steadily through the remainder of the year.

Demand for Trucks Good

Demand for Ford trucks and light delivery cars is reported particularly good, the company interpreting this as an indication of the optimistic attitude of business men and farmers toward expansion and greater efficiency in their transportation equipment. Sales of Ford trucks are reported to be more than double those for the same period last year, indicating the extent that business has bettered in the first half of the year.

The company reports a total absence of stocks of new cars in dealers' hands and states that buyers are taking them as rapidly as they can be delivered from the assembly plants. In most parts of the country, dealers are reported sold several months ahead, making certain the continuance of capacity operation for at least this period on this business alone.

Nearly 50,000 Assembled Abroad

DETROIT, July 16—Nearly 50,000 Ford cars and trucks were assembled abroad during the first six months of this year. This total, which surpasses that of any previous year, was announced here today by the foreign sales department of the Ford Motor Co., showing the production in the company's branches at Bordeaux, Buenos Aires, Copenhagen, Manchester, Sao Paulo and Cadiz.

The exact production was 49,712, the Manchester plant having been the leader with 18,267. Copenhagen came second on the list with 10,240, being followed closely by the Buenos Aires plant, which constructed 9601 vehicles. The Bordeaux plant is credited with 6217, while 3839 were built in Sao Paulo.

FORD FOREIGN ASSEMBLY FOR FIRST SIX MONTHS

DETROIT, July 16—Details of the foreign assembly production of the Ford Motor Co. for the first six months of this year are given as follows:

	Jan.	Feb.	Mar.	Apr.	May	June	Totals
Bordeaux	1,022	993	1,083	1,096	1,052	971	6,217
Buenos Aires ..	2,441	2,199	1,945	889	1,092	1,035	9,601
Cadiz	460	25	658	405	....	....	1,548
Copenhagen ...	701	1,343	1,920	1,934	2,179	2,163	10,240
Manchester ...	3,141	2,510	3,187	3,154	3,158	3,117	18,267
Sao Paulo	603	513	571	650	724	778	3,839
	8,368	7,583	9,364	8,128	8,205	8,064	*49,712

*All cars assembled at foreign plants and not shown in car exports of Department of Commerce.

The Cadiz plant is given a production of only 1548, this small figure being due to the fact that operations there ceased during April, preparatory to opening of the new plant at Barcelona.

The Ford plants at Antwerp, Montevideo, Trieste and Havana are not credited with any production, as their requirements are met by the shipment of knock-down vehicles from this country.

The total exports of the Ford company in the United States and the assemblies abroad during the first half of the year were announced as 77,171, thus showing that 27,549 vehicles were shipped from this country. Figures were not forthcoming to show the export shipments during the period from the Canadian factory, which supplies the British Dominions, such as Australia, South Africa, etc., these shipments being additional to the 77,171 reported here.

Sales High in Buenos Aires

BUENOS AIRES, ARGENTINA, (*by mail*)—Retail sales by agents and dealers of the Ford Motor Co. in this country are continuing at a high level, despite the winter season. The local branch has maintained thus far this year its monthly allotment of 1750 vehicles and expects the complete year to make new records.

Lincoln sales are being built up gradually and are attaining a satisfactory volume, considering the high price of this car when delivered here.

New Duesenberg Roadster Equipped with Rubay Body

INDIANAPOLIS, July 17—Duesenberg Automobile & Motors Co., Inc., has announced a new three-passenger roadster type with body by Rubay mounted on the standard Duesenberg chassis, already in production.

A full line of vehicles on the standard chassis with Rubay bodies will be in production by mid-July. Shipments of a line of seven-passenger phaetons and seven-passenger De Luxe limousines with bodies by this maker, in addition to standard sport and coupe, soon will be started.

All of the new body types are mounted on the standard 134-in. wheelbase Duesenberg chassis. A slightly higher belt line in the bodies, with contrasting color trim, adds to the appearance.

Kellam Gets Control of Milburn Electric

Will Handle Entire Distribution —Suydam to Continue in Charge of Service

TOLEDO, July 16—J. A. Kellam, for some time local dealer for Milburn Electrics, has acquired controlling interest in the electric passenger car business of the Milburn Wagon Co.

He will handle the entire distribution of cars in both the domestic and foreign fields.

H. W. Suydam, president of the company, who is soon to return from his trip abroad, will continue to head the factory service department.

The old Milburn plant was sold a few months ago to the Buick Manufacturing Co., of the General Motors Corp., but the operation of the plant on Grand Avenue here will continue as formerly under the new plan.

Associations in Industry Put by Government at 19

WASHINGTON, July 16—There are 1304 trade associations in the United States, according to a compilation by the United States Department of Commerce. Nineteen of this number are devoted to the automotive industry and are as follows:

Automobile Accessories Branch of the National Hardware Association of the United States, Automobile Body Builders Association, Automotive Equipment Association, Automotive Manufacturers Association, Automotive Wood Wheel Manufacturers Association, Automotive Metal Wheel Association, Cycle Parts and Accessories Association, Motor and Accessory Manufacturers Association, Motor Truck Association of America, Inc.; Motorcycle and Allied Trades Association, National Association of Automobile Show and Association Managers, National Automobile Chamber of Commerce, National Automobile Dealers Association, National Cycle Dealers Association and Tire and Rim Association of America.

Aeronautical Chamber of Commerce of America, Manufacturers Aircraft Association, Inc.; National Aeronautic Association of the United States and the World's Record of Aeronautical Commissioners, Inc.

Men of the Industry and What They Are Doing

Ralph Kaye Resigns

Ralph Kaye, for seven years advertising manager of the Kissel Motor Car Co. of Hartford, Wis., has resigned. For the time being he is enjoying a vacation during which he is endeavoring to improve his golf score. Kaye is undecided whether to continue in the automobile field or take up one of several offers in other lines.

Coleman Truck Consultant

John R. Coleman will retire Aug. 15 as chief engineer and factory manager of the Selden Truck Corp. of Rochester, N. Y., for the purpose of specializing on truck engineering in a consulting capacity. In addition to the Selden company, he also will handle several other accounts, with headquarters at 64 Lovering Street, Buffalo. Coleman has been active in the automotive field for the last eighteen years.

Dr. Baekeland Honored by France

Dr. L. H. Baekeland of Yonkers, N. Y., inventor of Velox and Bakelite, honorary professor of chemical engineering in Columbia University and president of the Bakelite Corp. and the General Bakelite Co., has been made an officer of the Legion of Honor by France. A similar distinction was bestowed upon him by King Albert of Belgium in 1919, when he was made an officer of the Order of the Crown of Belgium.

Elgin Names Blank Works Manager

M. H. Blank has been named works manager of Elgin Motors, Inc., of Indianapolis, of which J. H. McDuffee is president. Blank formerly was assistant general manager in charge of engineering and production of the Cole Motor Car Co. and at one time was connected in similar capacities with Aluminum Manufactures, Inc., Continental Motors, Cadillac Motor Car Co. and the General Electric Co.

Changes in Nash Division

James T. Wilson, vice-president and assistant manager of the Nash Motors Co., has taken over direct charge of the company's four-cylinder car division, following the resignation of B. W. Twyman. Wilson has been assistant manager of the Nash company ever since its organization and has been vice-president for the last three years. He has followed the fortunes of C. W. Nash since the days of the Durant-Dort Carriage Co., following him when he became identified with Buick and subsequently joining him at Kenosha. Twyman has been with Nash for four years, prior to which he served as general manager of the Inter-State Motor Co. of Muncie, Ind. At one time he acted as sales manager of the Studebaker-Flanders Corp. and later became a distributor for that product. George Bechtel, associated with Twyman for the last eight years, has retired as general superintendent of the Nash four-cylinder car division.

Pfeiffer Consulting Engineer

Benjamin S. Pfeiffer has been appointed a consulting engineer for the A. J. Detlaff Co. of Detroit, maker of clutches, malleable iron castings, etc., with offices in the First National Bank Building, Chicago.

Frank W. Warrington Resigns

Frank W. Warrington has resigned as sales manager of the Denby Motor Truck Co. He has not yet announced a new connection.

Hubbell with Greenfield Tap

R. B. Hubbell has been placed in charge of machine tool sales of the Greenfield Tap & Die Co. Previous to this connection he was associated with the Norton Co. and the Heald Machine Co.

Walsh Succeeds Coapman

C. W. Walsh has been appointed general manager of the Russel Motor Axle Co., succeeding John Coapman, resigned.

Thal & Bitter Appoints Hopkins

Ross Hopkins, formerly of the Motor Equipment Division of the Klaxon Co. of Detroit, has been made general sales manager of the Inshield light, manufactured by the Thal & Bitter Machine Co.

Wilson to Address Advertisers

Lee S. Wilson, sales manager of the Avery Co., Peoria, Ill., has been scheduled to address the National Direct Mail Advertisers' Convention in St. Louis next October.

Hendee Representative Here

Arthur Biden, Indian motorcycle representative at Sydney Australia, is at the Hendee Manufacturing Co.'s plant in Springfield, Mass., and will remain in this country six weeks.

Appointed Lomar Distributors

Fred Payne and Gus Litzou have been appointed factory distributors for the Lomar shock absorbers for Detroit and surrounding cities under the name of Lomar Detroit Co., located at 2932 East Canfield Street.

Bassick-Alemite Names Weeks

J. D. Weeks has been named general manager of the recently opened New York City branch of the Bassick-Alemite Manufacturing Co. of Chicago at 1885 Broadway.

Durant at Oakland Changes Personnel

Mulch Takes Charge of Interests in Canada and Is Succeeded by Arnold

OAKLAND, CAL., July 13—Several important changes have been made recently in the official personnel of the Durant interests here. R. A. Mulch has retired as sales manager of the Star plant and will take charge of all the Durant interests in Canada. Forest Arnold has been appointed to succeed Mulch as sales manager in this territory.

Mulch has been a Durant lieutenant for a number of years and Arnold has served as his assistant here since the start of the plant. Mulch was in New York when the announcement was made here on July 11 and went direct from there to his Canadian post.

Hawk Succeeds Steves

C. M. Steves, who has been general sales manager of the Pacific coast Durant plant in Oakland ever since the Durant interests came to this section, has resigned this post and has been succeeded by James W. Hawk, who also has been connected for a long time with the Durant companies.

Steves remains with the corporation in his position as vice-president but is now confining his attention to the development of the Durant-Steves Motors Co., Inc., in which he is associated with the younger Durant in the distribution of the Durant line along the Pacific Coast.

He assumes the dual position of vice-president and general manager of Durant-Steves Motors, Inc., and it is understood that the change was made entirely at his own request so that he might devote more time to his personal interests in the affairs of the Durant-Steves corporation.

Hawk's promotion is said to have been decided on at Indianapolis the night before the recent 500-mile race, although the announcement was not made until now. Hawk at one time was factory representative for the Durant interests on the Pacific coast, and in 1918 was sent by W. C. Durant to the Chevrolet plant at Fort Worth, Tex., as sales manager.

Former Assistant to Leahy

He remained there until the Durant organization was announced and then resigned to join the latter's forces in the new enterprise. He was sent to Lansing, Mich., to the Durant plant as sales manager and remained there until called to New York to take up the duties of assistant to M. D. Leahy, general sales manager, from which post he was sent to California.

Lower Prices Cause Tire Sales to Drop

Recent Action of Makers Meets with Almost Opposite Effect Than That Expected

AKRON, July 18—Tire price reductions enforced by practically all tire manufacturing companies last month, in the hope of stimulating buying activity among motorists, have had almost an exactly opposite effect in that they have tended to slow up sales. This is indicated by an analysis of existing conditions in the Akron district.

Manufacturers not only are curtailing production much more than had been predicted, but are warehousing tires to a great extent, and it is authoritatively reported in tire manufacturing circles that some companies are planning heroic measures in an effort to revive buying activity so that they may liquidate excessive finished goods inventories.

Tire production in the Akron district, which a few weeks ago was running more than 110,000 casings daily, has fallen to less than 80,000 tires a day. Rubber companies in many instances have dropped third shifts, have laid off men and have endeavored to secure additional warehouse facilities for tires which have backed up on them, due to the reaction arising from the price cuts.

Motorists Expected Increases

Following the price boosts of January and April, and the opening up of the tourist season, motorists had just begun to buy tires actively when the prices were cut. Whereas before the price reductions motorists were buying on the theory that other increases might come if they waited too long, the lowering of prices has had the effect of causing them to hold off on definitely contemplated tire purchases on the theory that other reductions may develop and that they will save money by waiting.

Dealers throughout the country, already heavily stocked, not only have protested the price cuts in a vigorous manner, but suddenly have stopped ordering for future delivery, preferring to turn over their present stocks before ordering new supplies.

Hence tire companies that figured the reductions would stimulate sales are finding themselves loaded up with excessive inventories of finished products, with all channels for dealer distribution temporarily clogged and with the market among motorists practically nil.

EMPLOYMENT DECLINES

BUFFALO, July 17—The small decrease in employment in this city during June occurred mainly in automotive plants, according to J. W. Ellithorpe, assistant superintendent of the New York State Employment Bureau here. This was due, he says, to the seasonal decline in the industry.

AIR SERVICE BY MAIL 96 PER CENT PERFECT

WASHINGTON, July 18—The Post Office Department reports that the air mail service for 1923 was 96.73 per cent perfect, the year's schedule flying totaling 1,589,389 miles, shuttling back and forth between New York and San Francisco. The record last year was 95.52 per cent.

It also is announced that a night air mail service will be realized by Aug. 1, operating between New York and San Francisco. In preparation for this the department has ordered 5,000,000 special air mail stamps, which will be in three denominations—between 10 and 12 cents, between 14 and 18 and between 22 and 28 cents.

English Makers Follow Michelin and Cut Lists

LONDON, July 10 (*by mail*)—The Michelin Tire Co. threw a bombshell into the British motor tire world last week by announcing a cut in prices of pneumatics averaging 10 per cent.

English companies individually and collectively held emergency meetings at once and decided to reduce their prices to a similar extent, although they had actually been considering an increase for the reason that since prices were reduced last year rubber has risen from 9d to 1s 3d per lb.

The companies assert that the cut now made will reduce their profits almost to a vanishing point and that Michelin was able to make its reductions merely on account of the low value of the franc.

Municipal Bus Question Rouses New York Mayor

NEW YORK, July 17—The municipal bus situation is in another tangle and Mayor Hylan, empowered to do so by the Board of Estimate, will ask the Governor to call a special meeting of the Legislature to legalize the operation of buses by the city.

This action has been forced by the Court of Appeals denying the city the right to appeal from a unanimous decision of the Appellate Division of the Supreme Court and ordering the service discontinued. This puts it up to Hylan to apply to the Transit Commission for certificates of emergency or discontinue the operation of the buses unless the Legislature will enact special legislation.

The city has been operating something like 400 buses in this service and it is estimated they carry about 250,000 persons a day, tapping sections that have been left helpless through the discontinuance of trolley lines. Hylan declares that if the Legislature will listen to his plan, he will ask the city for an appropriation of $25,000,000 for buses.

Shareholders Seek Coast Tire Control

Organize Into Seven District Groups in Effort to Remove Three Officials

SAN FRANCISCO, July 13—A legal struggle to obtain control of the Coast Tire & Rubber Co. of this city is on between Holmes Ives, J. J. Pankratz and N. J. Whelan, officers of the company, now under indictment for alleged violation of the Blue Sky Law, and stockholders who paid $10 to $15 a share for stock in the Coast concern, was revealed at a recent meeting of the stockholders here.

This meeting was called by a committee headed by T. R. Angove of San Francisco in an effort by local shareholders to protect their interests and to oust the president, vice-president and chairman of the board of directors, as named above, who are now at liberty on bail as a result of charges arising from the stock-selling activities of the Bankers' Mortgage & Discount Co., headed by A. R. Abrams and J. J. Eiseman, also indicted as violators of the Blue Sky Law.

About 300 stockholders gathered at this meeting, and H. P. Thayer was elected secretary. It was reported that the 6000-odd shareholders in the State had been organized into seven district groups.

Plant Worth Exceeds $1,000,000

O. B. Caldwell of Berkeley, who reported on the condition of the company, said that the plant, as a going concern, is worth from $1,000,000 to $2,000,000; that the indebtedness is less than $200,000, and that quick assets amount to about $400,000, but that, under present arrangement and management, the office expenses had been running twice as high as the actual production expense.

Caldwell pointed out that more than $3,000,000 in stock had been sold; that $1,000,000 worth of tires had been made, and that today, at a forced sale, there would be virtually nothing left for the people who bought the stock.

Organization of the stockholders was then effected, and a committee of fifteen elected, who, in turn, appointed from their own number seven as an executive committee. A voluntary assessment of 10 cents a share was voted. It was also unanimously voted to make every effort to compel those officials now under indictment to relinquish control of the company, carrying the matter to the courts if necessary to accomplish this objective.

BLACK & WHITE SCHEDULE

NEW YORK, July 14—The Black & White Cab Co., an operating concern, has filed in the bankruptcy court its schedule of assets and liabilities. Liabilities are given as $1,773,737 and assets as $104,393.

Move to Make Truck With Body Growing

Standard Types of Bodies Used by Many Leading Vehicle Manufacturers

DETROIT, July 17—The news that next month the Ford Motor Co. will begin to manufacture its one-ton truck model complete with cab and combination body, at prices considerably lower than were possible where chassis and body were purchased separately, carries with it an indication that truck makers generally, and the larger companies especially, are tending toward the equipment of their products with standard bodies, as a means of lowering initial truck costs.

There are a number of other truck companies in this district, General Motors and Republic among them, which have plants or are building them for body construction work, and which report a steadily growing popularity of the standard bodies. Republic has maintained its body plant since the company was first formed, and to this is ascribed in a large measure the success that the company experienced up to the depression period.

Under the plans of the new Republic organization, the body plant will be continued as one of the most important single assets.

G. M. Reports Increasing Demand

In announcing combination bodies recently, General Motors said it was doing so to meet the increasing demand from farmers and business houses for a fully equipped vehicle. The company has just finished building a special paint shop for its truck body work, made necessary, it declares, by the increased buying. General Motors bodies, thus far, are confined to the one-ton model and afford four combinations for general express work.

Reo is building its speedwagons in twelve body styles, having gone further in promoting the combination sale of truck and body than any company, but at the same time leaving all the unusual body types for the commercial body maker. The light delivery field is attracting the attention of passenger car makers more generally, but for the most part there has been no attempt to build the car complete, the body being left to the special body maker and the business being mostly on a to-order basis.

GASOLINE PRICE LOWERED

TOLEDO, July 16—The retail price of gasoline was reduced one cent a gallon by the Standard Oil Co. here this week. Station price is now 22 cents and wagon delivery 20 cents a gallon.

BRITAIN MAY TAX TIRES

NEW YORK, July 16—Cable advices from London state that British tire manufacturers are demanding that the government impose a 33 1/3 per cent import duty on tires, which have been exempt since 1915. In that year America agreed to ship all tires to neutrals through England, thus keeping them from reaching Germany. Last year the United States exported 240,926 tires to Great Britain.

Brown-Lipe Gear Adopts New Parts Marketing plan

SYRACUSE, N. Y., July 18—An unusual plan of marketing parts for the Brown-Lipe Gear Co. replacement parts is announced by that company. The present line of goods that will be offered for sale through the fifty-eight units in the Continental Auto Parts Co. comprises seven packages as follows:

10 unit package of clutch release bearings
10 unit package of clutch pilot bearings
20 unit package of clutch brake discs
500 unit package clutch facing rivets
500 unit package clutch drum key rivets
10 unit package of woven clutch facings
5 unit package clutch disc assemblies.

As the Brown-Lipe Gear Co. products are truck units, the sizes of these packages are designed especially for fleet owner use. The effort will be in pricing and marketing these parts to meet the competition of replacement parts not authorized by the unit manufacturing company. All parts are packed in well made and attractive boxes.

Westinghouse Automotive Service Engineers Meet

SPRINGFIELD, MASS., July 18.—A meeting of Westinghouse automotive service supervising engineers has just ended here. The meeting was presided over by M. B. Speer, service superintendent, some of the sessions being attended by representatives of the development engineering, manufacturing and sales departments.

Among the field engineers present were F. H. Robb, Chicago; F. L. Spohn, Cleveland; C. S. Burns, Detroit; R. C. Hewlett, Omaha; L. H. Eilcox, Pittsburgh; G. L. Valentine, Philadelphia; J. W. Calhoun, New York, and N. F. Fleming, St. Louis.

Central American Rubber Outlook Will Be Studied

WASHINGTON, July 15—Dr. H. H. Bennett of the United States Bureau of Soils has been assigned by the Department of Agriculture to accompany a party being sent by the departments of Commerce and Agriculture to investigate rubber production and possibilities for rubber growing in Central America. The party will sail for Panama on July 25.

The bureau has a representative with another party that will investigate the rubber outlook in the Amazon region of Brazil. The industry also has asked the Government to send a party to survey the possibilities in the Philippines.

Use of Cars Limited by City Congestion

So Alfred Reeves Tells Rotary Club in Detroit in Urging Relief Measures

DETROIT, July 18—Declaring that city congestion is proving a great obstacle to the use of motor cars, Alfred Reeves, general manager of the National Automobile Chamber of Commerce, in an address to the Rotary Club here today, brought out the fact that in the twelve largest cities of the country the total number of visiting cars daily averaged more than 40,000, and that more than 20 per cent of the traffic in those centers goes directly through the city, making either no stop at all or stopping for only a few minutes.

The talk was based on the fact that Detroit has just authorized the widening of Woodward Avenue as far as Pontiac, Mich., something that has been needed for years. Reeves asked the Rotary Club to get behind the movement and also to work for anything that will provide additional main thoroughfares connecting the city with outlying districts. Reeves said:

Rapid Movement Impossible

Detroit's case is typical. A great part of the traffic difficulties in our larger cities is due to the fact that vehicles cannot get in and out of the business areas rapidly. More than 20 per cent of the traffic in our big cities is going directly through the city, making either no stop at all, or only for a few minutes. The City Planning Commission in Chicago estimates that 25 per cent of its traffic is of this sort. In Pittsburgh the figure is 18 per cent for non-stop traffic and 20 and 25 per cent when brief-stop vehicles are included. The total number of visiting cars daily in our twelve largest cities averages above 40,000. In Pittsburgh it is 30,000, in Chicago, 45,000.

If we can avoid delay at the entrance to the city for these visiting vehicles, especially for the through percentage, the movement will be facilitated throughout the city. Lack of thoroughfares affects cars owned in the city, also, to be sure; because these are delayed when taking out of town trips. The delay not only hinders the free movement of vehicles within the city but reduces the efficiency of the motor vehicle as a means of transportation.

This city congestion is proving a great obstacle to the use of cars, and nothing could be more helpful to the industry than to see the situation cleared up. Detroit has 1867 motor vehicles per square mile, one to every six persons, a total of 170,000. The city uses the third largest number of motor trucks, namely, over 21,000.

Parking Should Get Attention

To widen existing boulevards or add more will not clear up all traffic difficulties, though it will be a great help. Parking is another matter to which those interested in civic welfare should pay their attention.

Merchants in suburban areas particularly will protect their future interests if they see that areas are set aside near the business district where customers may park cars.

50 M.P.H. Averaged in French Fuel Race

Light Car Gasoline Allowance at Rate of 39.3 Miles to American Gallon

PARIS, Juy 4 (*by mail*)—With a gasoline allowance at the rate of 39.3 miles to the American gallon, a two-seater Mathis car, driven by Lams, won its class in the French Grand Prix fuel consumption race at Tours, with an average speed of 50 m.p.h. for a distance of 185 miles. Bocchi, on a similar car, came in second, followed by Desvaux on a Salmson, Louis Rigal on Aries, and Gabriel on Aries.

In the four-seater class, where the allowance of gasoline was equivalent to 23.63 miles to the American gallon, Cabaillot on a sleeve-valve Peugeot was the winner at an average speed of 42.4 miles for a distance of 241 miles. Two other Peugeots, driven by Buteau and Bouverot, cut the line at practically the same time as the winner.

51 M.P.H. in Five-Passenger Class

In the five-passenger car class, called upon to average 15.7 miles to the gallon, André Boillot finished first at an average of 51½ m.p.h. for a distance of 310 miles. Boillot brought his two teammates, Alfred and Eugene Morillon, over the line half a length behind his car. Fourth place went to Floht, driving an Aries, who finished 32 min. behind the winner.

The fuel consumption race attracted comparatively little attention. With normal bodies, having clearly defined minimum dimensions, the start was given from cold with only the driver aboard, but with ballast equivalent to one, three or four passengers, according to the classes.

In the two-seater class there was considerable competition between the Mathis and the Salmson teams until the leaders of the latter team went out with either the radiators punctured by flying stones or the gasoline supply exhausted.

New Type of Valve in Engine

The winning Mathis cars were equipped with a new type four-cylinder valve in the head engine, which is expected to come on the market as a sporting model this year. The engine, having a bore and stroke of 59 by 100 mm., has a three ball bearing crankshaft and vertical valves operated by an overhead camshaft which is driven by chain from the rear. A couple of Solex carbureters were used, and the gasoline consumption was got down to 185 grammes per horsepower-hour. Compression ratio was 8 to 1. Delco ignition was used, with K. L. G. plugs.

The amount of gasoline being limited, the thinnest possible mixture was naturally used. There was an air control on the idler jet which allowed the engine to run on practically pure air when the throttle was closed for coasting down hill.

One of the features of the Mathis was the use of a rear axle housing in Alpax, an aluminum alloy having a density of 2.8, and giving a complete rear axle weighing only 66 lb. This metal is being experimented with by Mathis with a view to its adoption on stock cars.

Peugeot won in the four-seater class with a new stock model having a four-cylinder Knight type engine of 80 by 124 mm. bore and stroke which will come on the market this year. In the big car class the Peugeots had the Knight type engines which won last year at Strasbourg, fitted in the standard 18 hp. chassis. The compression ratio for these engines was 7 to 1. Use was made of a special type plug, made by Peugeot, with a complete water circulation around and through it.

Because of the limited amount of gas, all the competitors ran at about 70 per cent of the maximum power. While the average speed for the little cars was high, it was so obvious that the competitors were running at less than their maximum that the race was robbed of all spectacular features.

New York's Registrations in Half Year Were 50,289

NEW YORK, July 18—Decline in the registrations of new passenger cars in the metropolitan district for June is noted in the monthly sales analysis compiled by Sherlock & Arnold. Registrations of low and medium-priced cars fell from 11,287 in May to 9782 in June, and of those of higher-priced models dropped from the May figure of 992 to 731. Total registrations for the month were 10,513, as against 12,279 in May of 1923, and 9068 in June of last year.

For the first six months registrations of all new cars aggregate 50,289, as against 39,570 for the same period last year and 24,577 in 1921.

There are five cars that are leaders in the low and medium-priced field, with six others above the 1000 mark for the six months' period.

Two cars in the higher-priced class are leaders, with sales in excess of 1000. Six others showed registrations greater than 100.

A recapitulation for the six months follows:

	Medium and Low Priced	High Priced
January	2,814	201
February	2,801	580
March	8,102	769
April	11,124	1,106
May	11,287	992
June	9,782	731
Total	45,910	4,379

ASK COMPULSORY INSURANCE

LYNCHBURG, VA., July 16—Automobile owners in Virginia want a bill introduced in the next Virginia Legislature requiring a bond from all automobile owners as a guarantee to other owners for damages in accidents and to eliminate many irresponsible automobile drivers. It is proposed to draft a measure modeled after the one in effect in Massachusetts.

Bus Regulation Bill Up Again in Georgia

Legislature Gets Measure Like the One That Was Defeated Last Year

ATLANTA, July 18—A bill has been introduced in the Georgia State Legislature, now in annual session in Atlanta, to have the motor bus declared a common carrier, subject to the jurisdiction of the Georgia Public Service Commission, as is the case with the railroads and other public utilities in the State.

It is substantially the same bill introduced by the short line railroads last year and defeated through the efforts of the Georgia Motor Bus and Transportation Association, working in cooperation with the Georgia Automobile Dealers' Association and the Atlantic Automobile Association.

This year the same forces are combating the measure, with the work being principally handled by the legislative committee of the Atlanta Automobile Association and interested bus operators who are members of the State bus organization.

Indications at present, however, are that the bus industry will have a great deal more difficulty in defeating the measure than last year, due to the great increase in the number of bus lines throughout the State within the past six or eight months.

There are now approximately 30 per cent more bus companies operating in Georgia than at this time last year, and almost the entire State is covered by the bus transportation system.

South Carolina Regulates Buses

COLUMBIA, S. C., July 18—On Aug. 1 a new law goes into effect in South Carolina placing the bus industry largely under the jurisdiction of the South Carolina Railroad Commission, although the law in this State is not so stringent as the one being sought before the present session of the Georgia State Legislature.

Under the South Carolina law all drivers of motor buses are required to pass an examination before a State license will be issued to them. These examinations are now being conducted throughout the State by the railroad commission.

Furthermore, operating bus companies are required to deposit a bond before their license will be issued, the amount being on a graduated scale according to the passenger capacity of the bus. For buses operated solely for freight transportation, a bond is also required. Fares are to be regulated by the commission, and schedules maintained by the buses in operation.

As in Georgia, there has been an increase of between 25 and 30 per cent in the number of bus transportation companies operating in South Carolina within the past year.

Latin America Urged to Extend Highways

Great Interest Shown at Recent Conference—Motor Transport Encouraged

WASHINGTON, July 16—The construction of highways and the adoption of motor transportation where railroad facilities are lacking were recommended in formal resolutions adopted for all countries of Latin-America at the recent Pan-American Conference, held at Santiago, Chile.

The text of the highway resolutions has been translated into English and made public by Ralph H. Ackerman, chief of the Latin-American Division of the Bureau of Foreign and Domestic Commerce. The resolutions follow:

Recommendations Adopted

To recommend to the countries, members of the Pan American Union, that, especially when necessary railway communications are lacking, they improve as rapidly as possible transportation by means of automobiles between their most important cities, between these cities and the principal ports permanently opened to international traffic and between the national capitals and the capitals of neighboring countries;

To recommend to the same States that they send to the Pan American Union at Washington within six months after the close of this conference a report on the automobile highways that they at present possess, as well as those under construction and projected;

To recommend the celebration of a conference relative to transport by automobile in order to establish the international juridical position of automobiles and regulate their movement within the different countries;

That there be convened at a date and place to be determined by the governing board of the Pan American Union a conference on automobile highways to study measures best adapted to developing an efficient program for the construction of auotomobile highways within the different countries of America and between these different countries.

Delegates Show Keen Interest

In discussing the work of the Santiago conference, Ackerman says:

All of the delegates were so keenly interested in this question that they wished the subject to be studied carefully so that no mistakes might be committed which would tend to retard a movement for better highways. None of the delegations had technical advisers present who could discuss the subject from all angles, and it was felt that by asking the Pan American Union to gather full information and to call a later conference. all countries would be in a position to discuss just what they might do.

Intense interest was displayed in the question of issuing road bonds to cover the cost or a part of the cost of construction. One of the delegates particularly informed me that Argentina hoped to make a careful study of this practice in the United States.

Work of preparing the road surveys already has been undertaken, through the United States section of the Inter-American High Commission, under the direction of William A. Sherwell, the secretary-general. This material is being collected and distributed to the various national sections of the commission, in order to be ready for use at the forthcoming meeting.

Cooperating with the commission are Dr. Thomas MacDonald, chief of the Bureau of Public Roads, the American Automobile Association, the National Automobile Chamber of Commerce and other organizations, both public and private.

FINANCIAL NOTES

Borg & Beck reports earnings for six months ended June 30 at $327,962, which is equivalent to $3.28 a share on the 100,000 no par shares outstanding. After dividends and taxes there was left a surplus for the six months period of $171,145, increasing the total surplus as of June 30 to $926,819. Current assets now total $1,191,938 and current liabilities $52,299. The company has cash and Government securities totaling $626,432.

Moon Motor Car Co.'s earnings for the first six months totaled $751,410, before taxes, the company announces. Net profits, after taxes, are reported at $649,970, compared with net income, after taxes, of $795,139 in the full 1922 year. Sales for the first six months ran 200 per cent ahead of sales for the same period last year. Closed car demand was 60 to 65 per cent.

Ruggles Motor Truck Co. has been authorized by the Michigan Securities Commission to issue $250,000 in first mortgage 7 per cent serial gold bonds. Triangle Motor Truck Co. has been granted permission to issue $100,000 preferred stock to present stockholders only.

Chicago Motor Bus Co. reports revenues of $247,369 in June, which establishes a new high record, as compared with $180,512, the best previous month of last year.

Jordan Output for Year Reached Total of 10,147

CLEVELAND, July 18—Covering the twelve months ending June 30, the Jordan Motor Car Co.'s statement shows a production of 10,147 cars, which represents a 93 per cent increase over the preceding year. The sales volume totaled $15,029,456, and the inventory was turned approximately fifteen times during the period.

The sales and advertising expense ran 3½ per cent on the total volume of sales. The total volume of business done, the company states, equals approximately twelve and one-half times the company's authorized capital.

TRAFFIC CASES CLOG COURT

DETROIT, July 16—Traffic cases are clogging the Municipal Court to such an extent that last Friday Judge Keldan broke the trial record by sitting on the bench for fifteen and one-half hours, in which time he disposed of 641 cases, imposed several jail sentences and collected $4,681 in fines. An average of less than a minute and a half for each case was maintained.

BANK CREDITS

Written exclusively for AUTOMOTIVE INDUSTRIES *by the Guaranty Trust Co., second largest bank in America.*

Further quieting in industry and trade, in part seasonal, is in evidence. Further recessions in prices of farm products—wheat having fallen below $1 per bushel—are a depressing influence, although some of the idle cotton mills of the East have resumed operations on new orders and copper production has increased.

Wholesale prices, as measured by the Fisher index, again declined one point last week, to 153, representing a level 53 per cent above the 1913 average.

Building activity in June declined below the May record, as indicated both by new permits and contracts awarded. Bradstreet's compilation of permits at 153 cities showed a decline of 8.4 per cent, and contracts awarded in 36 States, reported by the F. W. Dodge Corp., declined 14 per cent from May. Aggregate permits and contracts each fell below the corresponding figures for June, 1922.

Labor Market Easier

Appreciable easing in the labor markets is appearing with the relaxation of activity in important lines of production, resulting in a more even balance between supply and demand.

Unfilled orders of the United States Steel Corp. declined 595,090 tons in June to 6,386,261 tons, the lowest unfilled tonnage reported since last August. This figure compares with 7,403,332 tons at the end of March.

Further evidence of a lull in domestic trade is shown by the reduced imports in June, a decline of $45,000,000 as compared with May, and the reappearance of an excess of exports after three consecutive months in which imports exceeded exports.

Car loadings for the week ended June 30 were the largest ever recorded. The handling of such a volume of traffic, with a surplus of cars available, is indicative of the ability of the railroads to handle promptly the expected heavy volume of fall traffic.

Discounts Decline

Discounts by the Federal Reserve Banks declined $83,500,000 in the week ended July 11, accompanied by a reduction of $12,600,000 in purchased acceptances. Deposits and Federal Reserve note circulation also declined.

American Motor Truck Receiver is Appointed

COLUMBUS, OHIO, July 18—After an all day hearing today Charles H. Spencer, publisher of the Newark *Advocate*, was named receiver for the American Motor Truck Co. of Newark, Ohio, a subsidiary of the R. L. Dollings Co. of Columbus, which is also in financial difficulties.

The application was opposed by the officers of the American truck company.

Ford to Ship 27,000 Tons of Ore Weekly

River Rouge Opened, Putting an End to Rail Transportation of Material

DETROIT, July 16—Iron ore deliveries from now until the end of the lakes shipping season at the Ford River Rouge plant will be at the rate of three cargoes weekly or an average of 27,000 tons, so by the time navigation closes there will be enough ore stored up to take care of all manufacturing requirements during the closed season.

The opening of River Rouge to navigation has ended railroad transportation of ore to Rouge plant, except in emergency cases, thereby effecting great economy in transportation costs, according to the Ford company. The first steamer in carried 5300 tons, its arrival being signalled as another achievement long planned by Henry Ford toward bringing greater plant efficiency.

A large percentage of the ore will be brought in from the Ford mines in northern Michigan.

The project of deepening and widening River Rouge was begun in 1917. By 1918 dredging by the Government had proceeded to a point permitting launching of Eagle boats during the war. River Rouge has been dredged from a stream 75 to 100 feet in width to 300 feet surface breadth, 200 feet bottom breadth and an average depth of 22 feet. It is expected to complete dredging by Aug. 1.

The Ford company has completed a docking slip 2614 feet long and 260 feet wide and, in addition, has constructed a giant turning basin, approximately 1200 by 1200 feet, which when completed will be turned over to the Government for acceptance.

Court Refuses to Halt Iowa Bus Law Operation

DES MOINES, IOWA, July 18—First attempts to nullify the motor bus law, passed at the last session of the Iowa Legislature, failed when Judge J. H. Applegate of the district court for Marion county denied the application for a temporary injunction sought by the Collins Oil Co. and the Manhattan Oil Co. to restrain the State Railroad Commission from making the new law operative.

By the terms of the law, which places motor transportation under the supervision of the railroad commission and fixes heavy taxes for passenger and freight transportation, oil companies which operate tank wagons are placed under the supervision of the commission. It was for this reason that the two oil companies sought to prevent the law going into effect. The law became operative July 1.

There is little question but that the oil companies will continue their fight, and it is thought that the case will come to trial on its merits at the fall term of court in Knoxville.

The new law, which requires the filing of heavy liability bonds, has sounded the death knell of the small bus companies, and already a number of those that have been operating out of Des Moines have ceased business. Others have reduced the number of their daily trips and eliminated the larger number of their buses.

INDUSTRIAL NOTES

Connecticut Blower Corp. of Hartford, Conn., has been incorporated under the laws of Delaware with a capital of $250,000. M. E. Keeney has been named president, with C. H. Keeney treasurer and C. E. Keeney secretary. The new concern has taken over the International Blower Co. and the Hartford Sheet Metal Works, whose products include blowers and exhaust fans, blower systems of all kinds, dust-collecting systems, exhaust systems, etc. The International plant will be used until fall, when a considerably larger plant will be occupied.

Manhasset Manufacturing Co., Putnam, Conn., will devote a part of its production hereafter to a high-grade cloth for automobile upholstery. The company is now working on its first orders and reports a good outlook. During the war a four-story addition to the company's plant was erected, but was not needed following the armistice and slack times. This building will be used for the manufacture of the new line.

Fidelity Machine Co. has completed its plant in Oakland, Cal., and has begun the manufacture of molds and cores for making tires and mechanical rubber equipment. The plant, which is immediately adjoining the plant of the King Tire & Rubber Co., is the only one of its kind west of Chicago. The company is a partnership between M. H. Gregg and E. M. McCurry.

Manley Manufacturing Co. of York, Pa., maker of garage and shop equipment, is building an addition to its factory which will add 14,000 sq. ft. of floor space. This will be used as a machine shop and by the painting and shipping departments. The company recently completed an entirely new building which is occupied by its general offices.

Holt Manufacturing Co., Peoria, Ill., manufacturer of the Holt caterpillar tractor, reports its East Peoria factory is working at war time capacity.

Cotta Transmission Buys Business of Lipman Pump

ROCKFORD, ILL., July 18—The Cotta Transmission Co. has purchased the oil and air pump business of the Lipman Pump Works and is transferring that part of the plant to its Rockford factory.

The Lipman company, which operates in Beloit, Wis., has been marketing pumps for two decades with a wide sale in garages and automobile supply stores. The refrigeration business, however, has been getting more attention lately from the Lipman company.

Cotta Transmission, in taking over the manufacture of the pumps, plans an extensive sales campaign.

METAL MARKETS

While the steel industry as a whole is operating at probably two-thirds of capacity, the rate of shipments of those products in which the automotive industries are particularly interested dips considerably below that ratio of output to capacity. Shipments are the only real yardstick for measuring activity amid conditions such as those now prevailing. It is astounding how the plethora of orders supposed to be on mills' order books a few months ago has vanished. Inasmuch as producers stoutly maintain that there have been no cancellations, it must be assumed that a considerable quota of the orders which were said to have been placed during the buying movement, and the remnants of which were later referred to as a sufficient backlog to tide the industry over the remainder of the year, consisted of business that was anticipated but for some reasons or other did not reach the contract stage.

It is now freely conceded by producers that shipments are kept down by consumers who balk at taking in material for which they have no immediate consuming use. It is an almost invariable experience that buying movements in the retrospect turn out to have been of much smaller magnitude than they were estimated to be while under full headway, and the recent one formed no exception to this condition. Many of the sheet rolling mills are still inactive, and those that are not down are satisfied to operate at a relatively slow pace.

What is more significant than these rumors is that buyers show not the slightest interest in them. Hot-rolled strip steel which a few months ago was difficult to obtain at 3.30 cents is now freely offered at 3 cents. Alloy steels present a neglected appearance. In the steel trade itself majority opinion inclines to the view that when a change in prices does come it will be in a downward direction, but the more knowing ones find solace in the thought that when buyers stay out of a market in concert, they very likely will have to come back for supplies at one and the same time, and the effect of such unison in buying on price levels is more than likely to offset any declining tendency of the market. For the time being fresh buying is confined to small tonnages of specialties and fill-in requirements.

Pig Iron.—Automotive foundries are no exception to the general run of melters, all of whom appear to have turned their backs upon the market, which is as feeble as can be. Production is slowing down, and the same conditions as those obtaining in the 1921 slump, that had its aftermath in $35 pig in the fall of 1922, are noted.

Aluminum.—Except for an occasional lot of resale metal in the Detroit or Cleveland market, the situation continues a routine affair. Imported metal is not offered, and the domestic producer is merely looking after the regular wants of contract customers. Not only in the United States, but in Europe as well, producers are striving to sell their aluminum in as highly finished a form as possible because of the extra profits involved. There is more money in selling sheets than ingots, and the Germans continue to make shipments of finished aluminum ware, although they have virtually ceased shipping metal.

Copper.—The market is slightly steadier and a somewhat better feeling prevails. Wrought copper and brass mills and wire drawers show more interest in the metal.

Calendar

SHOWS

Nov. 4-10 — New York, First Automobile Exposition of the Foreign Automotive Association, Hotel Astor.

Nov. 11-17—New York, Annual Automobile Salon, Hotel Commodore.

Jan. 26-Feb. 2—Chicago, Annual Automobile Salon, Hotel Drake.

FOREIGN SHOWS

Sept. 28-Oct. 7—Berlin, Automobile Show.

Oct. 4-14 — Paris, Passenger Cars, Bicycles, Motorcycles and Accessories, Grand Palais.

Oct. 15-20—London, Motorcycle Show, Olympia.

Oct. 24-Nov. 2—Paris, Trucks, Agricultural Tractors, etc., Grand Palais

Nov. 1-15—Buenos Aires, Annual Automobile Exposition, under the direction of the Automovil Club Argentino.

Nov. 2-10—London, Automobile Show, Olympia.

Nov. 22-Dec. 1—London, Motor Transport Exhibition.

Dec. 8-19—Brussels, Passenger Cars, Trucks, Airplanes and Motor Boats, Aviation Palace.

RACES

Sept. 3—Annual Pikes Peak Hill Climb.

Oct. 28—Barcelona, Spain, Grand Prix for vehicles of 1500 c.c.; Nov. 1, International Grand Prix for cycle cars of 1100—Nov. 4, International Grand Prix for two liter.

CONVENTIONS

Oct. 24-26—Cleveland, Thirtieth Annual Convention of the National Association of Farm Equipment Manufacturers, Hotel Statler.

Nov. 12-17 — Chicago, Annual Business Exhibit and Convention of the Automotive Equipment Association, Coliseum.

S. A. E. MEETINGS

Oct. 25-26—Production Meeting of the S. A. E.—Cleveland.

Jan. 1924—Annual Meeting of the S. A. E.—Detroit.

MEETINGS

Sept. 19-21—Boston, Fall Meeting of the Motor and Accessory Manufacturers Association.

5000 Members Wanted for Old Timers' Club

CHICAGO, July 18—An effort has been launched by Harry P. Branstetter, president, and other officers of the Old Timers' Club to enroll a membership of at least 5000 of the veterans of the automotive industry.

A new design for a button to be worn in the coat lapel by members has been adopted and each member who pays the annual dues of $5 will receive one of these gold buttons. The button is shaped somewhat like a coronet, with the design of an early automobile at the top, an hour glass below it with wings on either side, and at the bottom space for rubies —one for each five years of service in the industry.

An embossed membership card is issued to each member. In making up the new roll membership card No. 1 has been assigned to Elwood Haynes, No. 2 to Albert Champion, No. 3 to W. L. Hughson of San Francisco, and No. 4 to Branstetter.

When the present officers and directors were elected at a meeting in Chicago last winter, the club had been rather inactive for a period. There was turned over to Branstetter a list of about 1200 names of men who had paid dues in 1921. He is sending letters to all these men, asking them to bring their membership up to date by paying the current dues.

Branstetter also has a list of more than 5000 names collected at the time of the organization of the club a few years ago. He hopes to bring most of these into active membership.

Refiners Suggest Changes in Federal Specifications

WASHINGTON, July 16—A revision of Federal specifications for gasoline and lubricating oils was recommended at a meeting in this city of representatives of the petroleum industry with the Federal Specifications Board. The new specifications become effective Jan. 1, 1924.

The concrete recommendations are that a limit of 0.1 per cent be placed on the total sulphur in all grades of gasoline, this to be determined by the lamp method; that the unsaturation test be eliminated or made more lenient, and that the specification for motor gasoline be known as United States Government motor gasoline. The only other change of importance recommended in regard to gasoline was to discontinue the use of cotton on the bulb of the distillation thermometer.

The refiners also recommended that the sulphur limit on kerosene be raised to 0.125 per cent, and that the burning test be increased to sixteen hours. It was recommended that the committee follow the recommendation of the signal section of the American Railway Association in regard to the specification for long-time burning oil.

The main change on lubricating oils recommended was that embodied in the new method of the American Society for Testing Materials for determining color. A discussion of carbon residue limits in the various oils followed.

New Gasoline Substitute Tested Out Successfully

WASHINGTON, July 16—A new gasoline substitute has been tested successfully by the Government at the Anacostia Air Station, according to an announcement by the Navy Department. The substitute is a synthetic compound composed of 30 per cent denatured anhydrous alcohol and 70 per cent common gasoline. The department claims that the substitute is cheaper in cost and yet develops the same horsepower as high-grade aviation gasoline with less heat to the engine.

Further tests, the department announces, will be made before definite conclusions are reached. Aviation experts declare that the new mixture will develop horsepower equal to that derived from high-grade aviation fuel with the very material advantage of less heating of the cylinders.

JOHN W. O'BANNON DEAD

NEW YORK, July 16—John W. O'Bannon, at one time head of the O'Bannon Corp., which for several years made the upholstery for all Ford cars, died Friday in a private sanitarium.

Packard Car Dealer Can Sell Motor Boat

DETROIT, July 17—Through an arrangement entered into by the Packard Motor Car Co. with the Great Lakes Boat Building Corp. of Milwaukee, the latter is given permission to sell its Packard motor equipped boat through such members of the Packard sales organization as are in a position to promote and handle successfully motor boat sales.

The arrangement so far as sales are concerned rests between the boat company and the dealer, Packard participating only in consenting to its dealers handling the boats if they are disposed to do so.

In the plan to permit dealers to combine motor car and motor boat sales wherever feasible, there is offered the possibility of developing boating as a much more popular sport than it is now, Packard says. As its share in the development, the Great Lakes company will produce a standard craft upon which a price of $4,500 list, war tax $360, has been set when equipped with a Packard engine. Packard will build the engine, which will be an adaptation of the single-six designed for marine use.

Description of Boat

General description of the boat shows that it will be a 26-ft. mahogany runabout of the de luxe type, with a speed of 18 to 20 m.p.h. It will have a cedar plank bottom and will be upholstered in blue leather with box spring seats. It is the aim of the builders and the Packard company to have it conform in its appointments to the Packard cars.

The Packard organization, through which the company may sell its boats, numbers about 800, but it is not expected that the sale for the present will extend beyond the larger dealers, or those smaller dealers especially well situated to handle boats. The proposition, however, is open to the entire organization. Servicing will be centered in the hands of the boat company, dealers not being expected to carry any parts until at least such time as their boat business mounts to a point where stocks will be warranted.